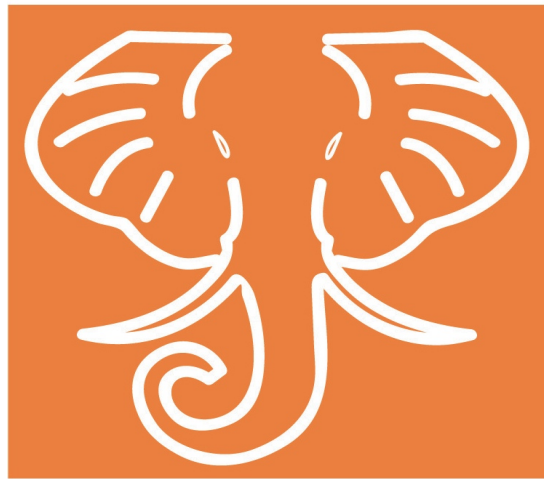


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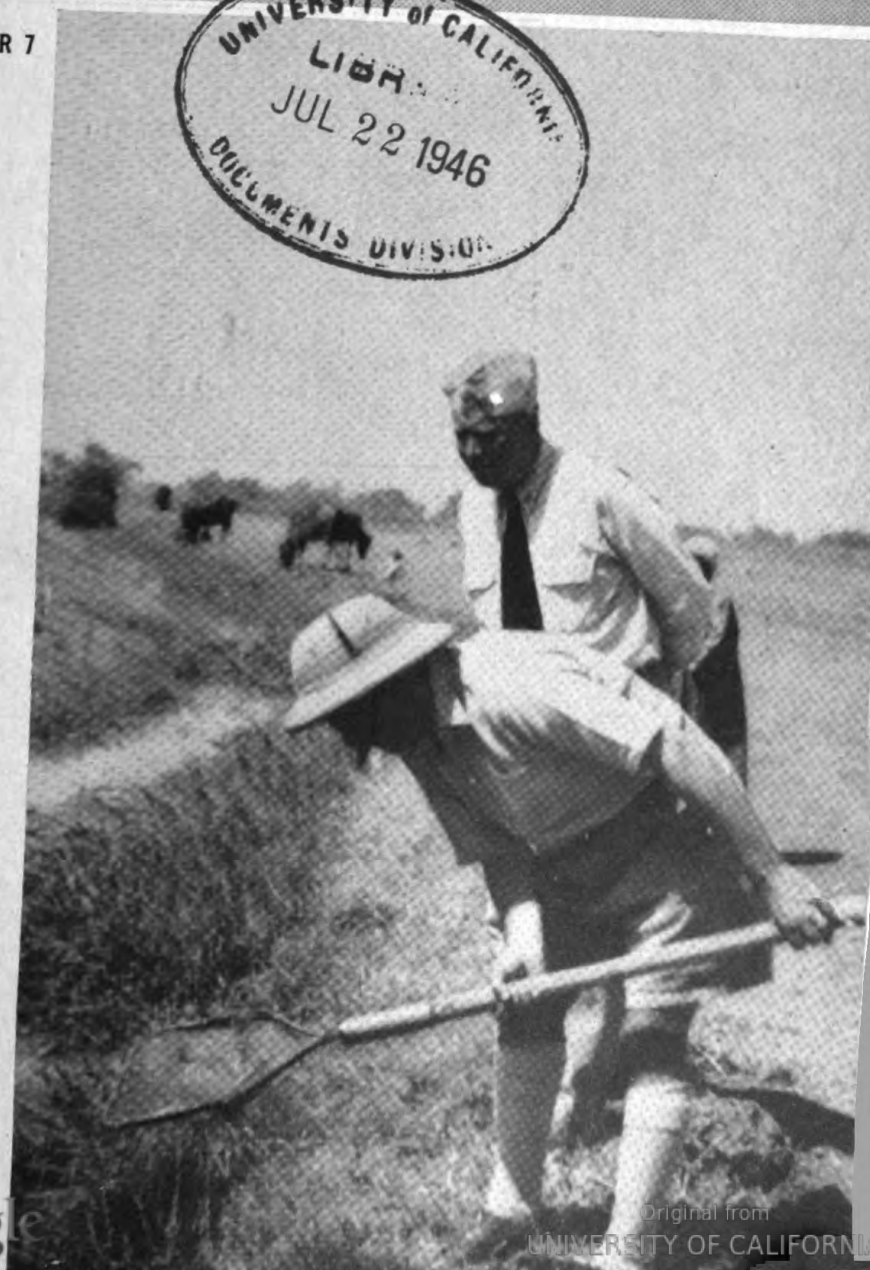
NUMBER 7



JULY 1946

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED 112



COVER PHOTOGRAPH

Naval medical officers survey a canal in Egypt for snails. This is a phase of the work performed in the study of schistosomiasis described at length in an article by Commander J. M. Amberson, (MC) USNR, appearing in this issue.

—Official U. S. Navy photo.

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY.
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated :

All numbers up to and including 1921.

Volume 16, 1922, Nos. 4 and 5.

Volume 17, 1922, Nos. 4 and 6.

Volume 18, 1923, Nos. 1, 2, 3, and 5.

Volume 19, 1923, Nos. 2 and 3.

Volume 20, 1924, Nos. 2, 5, and 6.

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Volume 25, 1927, Nos. 1 and 4.

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II

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of that Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T McINTIRE.

Surgeon General, United States Navy.

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Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

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All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

LOUIS H. RODDIS, *Editor,*
Captain, Medical Corps,
United States Navy.

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U. S. NAVAL MEDICAL BULLETIN

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No. 7

SPECIAL ARTICLES

SCHISTOSOMIASIS AND ITS CONTROL IN EGYPT

JULIUS M. AMBERSON
Commander (MC) U. S. N. R.

This memoir will deal primarily with bilharzia disease caused by *Schistosoma mansoni* and *Schistosoma hematobium* in Egypt.

DEFINITION

Schistosomiasis is an infestation of man by a trematode of the genus *Schistosoma*, commonly known as a blood fluke. There are three species of schistosomes which affect man:

1. *Schistosoma japonica*—produces a grave chronic disease with abdominal hepatic and dysenteric symptoms. Man and several animals are the definitive hosts.
2. *Schistosoma mansoni*—produces abdominal and dysenteric symptoms and splenomegaly. Only man is affected.
3. *Schistosoma hematobium*—invades the vesical and pelvic venous plexuses of man and produces hematuria. Only man is affected.

HISTORICAL

Schistosomiasis is endemic in Egypt. It has been present since ancient times.

Before 1847, investigators had not associated schistosomes with the disease. For lack of etiological factors, they lumped schistosomiasis and anemias all under the heading of "Egyptian chlorosis," a term now limited to ancylostomiasis. In that year Pruner stated that he believed the disease was caused by various types of worms he found

at the autopsies of Egyptians in Cairo. This basic inference made pathologists more alert to the possible damage worms could produce in the organs of the body.

It was Bilharz and Griesinger, both teachers in the Cairo Medical School, who first connected these parasites with the extremely prevalent anemias. In 1852 Bilharz associated specific worms in the portal system and vessels around the bladder with the endemic hematuria common amongst Egyptians. Subsequently many minds began to concentrate on the problem of the life cycle of bilharzia worms and the manner of infection of the human host.

Sonsino, from 1874 to 1884, examined large numbers of snails in Egypt for evidence of an intermediary stage of bilharzia worms. Although he failed, his researches were valuable in determining other cercariae in Egyptian freshwater mollusca.

Later on, Loess attempted, but without success for many years, to discover the intermediate host which he suspected to be a mollusk. This failure led him to infer that no intermediary host was essential in the bilharzia cycle. Loess's work, however, resulted in the discovery of the dermal method of infection by ancylostoma larvae, one of the most far-reaching discoveries in parasitology.

No exact data as to the extent of the infestation with bilharzia worms in Egypt were available before 1913, although it was inferred from the high percentage of cases among hospital patients that the disease was possibly the most widespread serious malady in Egypt. Bilharziasis was definitely traced in Egypt by Ruffer (1910) back to ancient times. He demonstrated bilharzia ova in sections of kidneys from ancient Egyptian mummies of 1250-1000 B. C. Hematuria was one of the diseases recorded by ancient Egyptians and prescriptions for the treatment of the condition have been discovered in medical papyri. The parasitic nature of the disease was never recorded.

Larry (1812-1817) in his "Memoires de Chirurgie Militaire et Campagnes," stated that the symptoms of the disease, especially hematuria, were frequent amongst the French troops during the Napoleonic Expedition to Egypt (1790-1801).

Greisenger (1866) recorded that 32 percent of 363 autopsies had evidence of bilharziasis. Sonsino (1874) recorded 46 percent of 91 autopsies with bilharziasis. Kaufman (1894) recorded that 33 percent of 500 autopsies had bilharziasis. Ferguson (1910) recorded that 40 percent of 1,000 male autopsies at Kasr el Aini Hospital, Cairo, had bilharziasis.

To check these serious ravages of ancylostomiasis and bilharziasis, Lord Kitchener in 1913, in his annual report stated: "* * * It is

high time that serious steps should be taken to prevent the continuity of infection that has been going on so long in this country."

Upon this initiative the Egyptian Public Health Department formed a scientific advisory committee to formulate policies and plans for the collection of data, initiated survey work, established hospitals and programs for the treatment and control of bilharziasis and other parasitic diseases. In February 1914, the director general of the International Health Division of the Rockefeller Foundation, Mr. Wickliffe Rose, visited Egypt and made a careful study of plans made by Egypt's advisory committee. As a result of his recommendation, the commission granted a sum of \$30,000 on the condition that the Egyptian Government put up an equal amount for the work. This magnificent gesture enabled the work to go ahead on a much larger scale than was at first anticipated. As a result a survey showed that 57 percent in a large sample (approximately 30,000 people) were infested. Certain laboratory techniques, methods of treatment, and features of the epidemiology of the disease were recorded upon which Leiper later drew, after his epochal discoveries.

Miyairi and Suzuki (1913) in Japan had been working on the etiology of the Japanese schistosomiasis. They discovered that an insignificant-looking small mollusk of the genus *Katayama* was the intermediate host of *Schistosoma japonicum*. This brilliant work gave man the first definite knowledge that an intermediate-host problem existed in schistosomiasis. Since that time, Faust, Barlow, Cort, Khalil, Azim, Helmy, Porter, Cawston, Bartsch, Girges, Magath, Wright, and others have recorded that numerous species of inconspicuous mollusks share with man and other mammals an ailment that may affect a hundred million inhabitants of China as well as many millions of inhabitants of Japan, Formosa, the Philippines, Africa, South America, and at least half of the population of Egypt.

The question of finally elucidating the life history of the bilharzia worm fell to the Englishman, Doctor Leiper, who came to Egypt in 1915 from Japan where he had been associated with Miyairi and Suzuki. Leiper, having a new concept of schistosomiasis, quickly solved the perplexing question in Egypt. He almost immediately identified the snail hosts and discovered cercariae which attack the human beings as they work in the muddy canals and waters that irrigate their lands.

Leiper happened by chance to arrive at the most favorable time to begin his work. Subsequent studies by Barlow have shown that the spring and early summer seasons are the ones in which the highest number of infected snails is found. Leiper arrived in Egypt when the weather was warm, the Nile River low, and the streams sluggish, factors very favorable for snails to propagate or to become infected

and a time when cercariae were beginning to emerge from the snails. Forearmed with his new concept of the disease, he quickly shed light upon Egypt's great national health problem. He proved, furthermore, that the urinary and intestinal varieties of the disease are caused by two different species of the genus *Schistosoma*, *hematobium* and *mansoni* respectively.

Moore and Kellerman (1904) found copper sulfate to be an algicide which later led to its discovery to be a molluscicide. Chandler (1920), experimenting with local snails in the United States found that they were susceptible to very low dilutions of copper sulfate. This author concluded that the intermediate host of schistosomiasis would also be susceptible to copper sulfate.

Khalil and Lee (1921), experimenting with *Planorbis boissyi* and *Bulinus truncatus* in Egypt, found that these snails were killed by 1:1,000,000 dilution of copper sulfate in tap water in 5½ hours immersion.

Up to the time of the discovery of the life history of the parasite, no curative treatment for man was known. MacDonagh (1915), in his book on the "Biology and Treatment of Venereal Diseases", stated that he had succeeded in curing cases of bilharzia infestation with sodium antimonyl tartrate. After extensive trials on many cases by Christopherson (1918) at the Khartoum Civil Hospital in the Anglo-Egyptian Sudan sodium antimonyl tartrate came into general use as a specific for bilharziasis.

The First World War (1914-18) unfortunately paralyzed much of the work in Egypt due to the extension of hostilities to the Near East and the beginning of the Dardanelles campaign. Great demands were made on hospital accommodations for British wounded. The work was suspended from 1915-19.

In 1919, Professor Day revived interest in combating this disease. An annex was attached to the Kasr el Aini Hospital, Cairo, which became a teaching center for physicians for such work in the provinces. Under his direct supervision, principles of treatment were established.

A new advisory committee was appointed and held its first meeting on January 19, 1921. The lines of action against bilharziasis and ancylostomiasis were laid down as follows: (1) Treatment; (2) investigational survey; (3) propaganda; and (4) experimental work in connection with soil and water pollution.

The committee designed and developed field units in which patients of both sexes could be routinely examined and treated, and proper records could be kept of dosages and course, and of laboratory procedure.

Treatment of bilharziasis with emetine was introduced by Dramantis and Erian and found to be effective. The high cost of emetine in

Egypt has militated against its routine use for out-patients, but it is a useful alternative with sodium antimonyl tartrate for young children whose veins are too small for intravenous injections, for patients who have an intolerance for sodium antimonyl tartrate, and for cases of bilharzial dysentery complicated by amebiasis.

The Church Missionary Society of Old Cairo took a deep interest in the treatment of ancylostomiasis and bilharziasis on a large scale from 1905-23. During these 18 years they treated 103,836 cases, according to Dr. Coleman of the society.

Ibrahim Murad Pasha, a wealthy land owner of Qalyubiya Province, undertook in 1913 to maintain a 30-bed hospital at the village of El Deis. The government provided a doctor but all other expenses were met by Murad Pasha. In 1916, the hospital closed, as Murad Pasha could no longer afford to meet the expenses and there was no agency to carry on for him. They had done splendid work and it was well patronized by patients.

Since that time, many hospitals throughout Egypt have set up facilities and trained personnel to treat bilharziasis. There are several factors which cause irregularity of attendance:

1. Need to keep even sick labor in the fields during the principal seasons of agriculture;
2. Weather influence on the number of patients. During the summer more come in for treatment than in winter;
3. During Ramadan (August to September, the month of "fasting" of the Mohamedans) the attendance is usually very low, as they strictly abstain from food or water between sunrise and sunset and the taking of medicine or injections during this period is regarded as breaking of the "fast." Only those severely ill or injured take treatment during this period; and
4. Economic conditions are an important factor. When work is to be had, the examination centers don't have so many patients, and treatment is postponed, however urgently it is needed.

It was then decided to bring the hospital to the patient instead of having the patient come to the hospital.

About 120 mobile units were designed and equipped to reach all the rural areas so the sick could be found and treated. These units are divided into three parts:

1. *Diagnostic group.*—These move on ahead of all others in an area, make a survey of all people, take histories, do laboratory work on stools and urine, and record all data;
2. *Treatment group.*—Treat all infected subjects with sodium antimonyl tartrate (full course); and

3. *Follow-up group*.—Checks all cases at end of course of treatment and re-treats those showing evidence of residual schistosomiasis infestation.

The many mobile hospitals and their personnel serve admirably to meet part of this large public health problem of coping with the diseased population, but so far have never caught up with all of the diseased individuals.

In September 1941 the Ministry of Health set up a special division, independent of the hospital section, for snail destruction. An initial appropriation of £50,000 (about \$200,000) was made available with which to organize and equip this new section. Dr. M. Abdel Azim, a physician and recognized researcher in parasitology, was made its first director and still holds the post. Intensive ecological studies of snails and the application of methods for their destruction has been the major activity of the section ever since.

GEOGRAPHICAL DISTRIBUTION IN EGYPT

The Nile delta begins at Cairo where the river breaks into several branches. The delta can be circumscribed by an equilateral triangle roughly 160 kilometers on each side. Within these borders lives, roughly, one-half the population of Egypt. In this area schistosomiasis caused by either *Schistosoma hematobium* or *Schistosoma mansoni* is endemic and at least one-half of the people are affected. The snail vectors found here are respectively *Bulinus truncatus* and *Planorbis boissyi*.

Quite a different picture presents itself up the Nile. All along the Nile, south of Cairo to the frontier post at Wadi Halfa and on to Khartoum in the Anglo-Egyptian Sudan where the Blue and White Nile meet to form the main stream, only *Schistosoma hematobium* infestation is found in the natives. The only snail vector found is *Bulinus truncatus*. Also in the three oases, Fayum, Dakhla, and Kharga, in the western desert southwest of Cairo, only *Bulinus truncatus* snails are found and are infected with *Schistosoma hematobium*.

Incidentally, a fluke in cattle livers known as *Fasciola hepatica* is extremely prevalent in the Kharga Oasis and has almost destroyed all cattle-raising there. The responsible snail is the *Lymnaea caillaudi*. Great efforts also are being made to wipe out this snail in the Kharga along with bulinus.

LIFE CYCLE OF SCHISTOSOMES

A general account of the life cycle of *Schistosoma hematobium* will serve, as the sequence of the cycle is the same for any schistosome which affects man.

The egg is identified by its terminal spine. It usually is passed from the human body with the urine but may sometimes be found in feces as well. The egg when passed often contains a fully developed embryo, which can be seen under the microscope moving within the eggshell. When this egg is placed in warm water it soon will hatch. A ciliated larva, known as a miracidium, escapes from the egg shell and swims actively about. It may do this for about 6 or 8 hours and if, within that time, it encounters a suitable mollusk such as *Bulinus truncatus* in Egypt or *Physopsis africana* in South Africa, it penetrates and undergoes further development. If not, it dies.

Assuming that a suitable snail is encountered, the miracidium either enters the snail by the respiratory pore or penetrates some part of its body such as the foot, being aided in penetration by a secretion it produces. Eventually the miracidium reaches the digestive gland (liver) of the snail host where it rapidly develops into a hollow elongated bag known as a sporocyst. From the cellular layer of the sporocyst, buds are produced which elongate and are known as daughter sporocysts. These escape from the primary sporocyst, remain in the snail's liver, and in turn, form cercariae. In the crushed livers of these infected snails a tangled mass of baglike, elongated, colorless sporocysts will be found. Sporocyst formation eventually ceases as the snail's liver tends to disintegrate from the overwhelming infection.

Forked-tail cercariae may be seen to have formed in some of the sporocysts or are wiggling about freely, ready to leave the host.

When observing an infected snail in a small beaker of water with a hand lens the cercariae may be seen to emerge in puffs or bunches from the respiratory pore of the snail into the water. When held up to sunlight, and by getting the reflection of the light from the cercariae just right, they can be seen with the naked eye somewhat widely dispersed, rising to the surface and sinking again. It is more pleasant to the eye, however, to watch them through a hand lens and to observe their forked-tails spread out at right angles as they sink. They have a characteristic convulsive action by which they violently propel themselves upward in the water to the surface. They then sink slowly to varying depths, to repeat the action all over again. Experts claim they can detect by the rapidity and nature of movement of the cercariae, whether they are *Schistosoma mansoni* or *Schistosoma hematobium*.

These cercariae can live anywhere from 24 to 60 hours in fresh water but their average length of life is about 48 hours. This is an important point to bear in mind to avoid infestation, if water is stored for drinking or washing purposes in the field. They swim about freely in a fresh-water canal or stream and must find a human being within 48 hours or they become weakened and die.

They have anterior and posterior suckers, by which they can fasten themselves to the human skin, and glands whose secretion helps to dissolve the skin. As these cercariae fasten themselves down they lash their tails violently and cast them off.

They are capable of penetrating the skin of any part of the body that is exposed and disappear beneath it within 10 seconds. Where they enter, pinpoint reddish irritated spots will be found.



1. Classical skin lesion experimentally produced in the laboratory by a 15-second exposure of the skin to the cercariae of *Schistosoma hematobium*. In 6 weeks the subject was passing the ova in the urine.

After the tail is shed and the head and part of its body has penetrated, that portion of its body which has entered swells itself up sufficiently to get a firm hold under the edge of the skin where it entered, and then it pulls the rest of its body in after it and disappears under the skin. From here on it can be imagined that these larval worms work their way through the lymphatics and blood vessels to reach the portal system and liver where they come to rest and grow to attain sexual maturity. They then migrate to the veins of the bladder or rectum where egg laying takes place.

The sexes of schistosomes are separate. Although they are essentially flat worms the male, when sexually mature, simulates a round worm, for the margins of his body are curled over, one edge overlapping the other, to form the gynecophoric canal, into which the female creeps where she remains *in copula*. The male, aided by his powerful suckers, moves into the mesenteric veins and eventually reaches the bladder or rectum, depending upon which form of bilharziasis is present. The female is said to leave the male and migrate to the capillaries. In this location the female lays egg after egg, contracting her body and moving away from an egg as it is delivered to lay another. Thus, a whole string of eggs is laid filling a capillary. The mechanism by which the sharp terminal-spined eggs reach the bladder cavity is not fully known but many theories as to how it occurs have been developed. The important fact is that the egg reaches the bladder cavity or lumen of the bowel to be passed along with urine or feces. Oviposition is not restricted entirely to the bladder and rectum, and may occur in the liver, lung, brain, and kidney tissues.

STRUCTURE AND BIOLOGY OF *SCHISTOSOMA HEMATOBIMUM*

The structure and biology of the various stages in the life history of *Schistosoma hematobium* in the molluscan and mammalian hosts will be taken up as follows: Ova, miracidia, sporocysts, cercariae, and adults.

OVA

The *Schistosoma hematobium* egg when found in freshly passed urine is more or less oval. There is a good deal of variation in the exact size and shape of ova from a given specimen of urine but they will vary from 50 to 90 microns in breadth and 115 to 180 microns in length. The outer shell is chitinous with a solid terminal spine at one end of the long axis. The spine varies in length and sharpness.

During the course of clinical work in Egypt it was noted that ova in fresh specimens of urine would nearly all hatch out in a few minutes when warm water was added. Specimens of urine that were held

over for a day or longer would contain a large number of dead ova. Eggs to be used for experimental work on snails in the laboratory should be used reasonably fresh to be effective.

MIRACIDIA

The miracidium itself is a somewhat boat-shaped organism covered by cilia and a tough cuticle. It has a central nervous system, a single digestive tube which splits into two parts, an excretory system of two independent tubules each associated with two "flame" cells, genital rudiments in the posterior third of its body, and a gland with ducts on each side of the mouth which secretes a digestive fluid that enables the organism to break down the protective skin armor of a snail.

Within the egg the miracidium is capable of active rotation, contraction, and expansion. These movements aid in bursting the thin shell of the egg as it reaches maturity. A longitudinal slit in its wall may appear where the miracidium escapes from its cloistered existence. It rests for a few seconds, as if to get its bearings and accustom itself to its new form of existence, and then begins to swim about and feel the freedom of a new environment.

The duration of life of a free-swimming miracidium is about 8 to 10 hours and in that time it must find a specific snail host in which to develop into a cercaria or die. That these miracidia are attracted toward a specific snail, is undoubtedly true, as borne out by many investigators. It has been found that the influence of direct sunlight in inducing a more rapid attraction toward the specific snail is a great factor in the density of infection of specific snails. The best way to learn about this very interesting organism is to go to the miracidium itself and study it.

SPOROCASTS

The main sequence of events of the embryology of the sporocysts and cercariae is as follows:

Mother sporocysts.—The miracidium first becomes an elongated sac, without cilia when mature, losing all its miracidial structure. An outer layer of cells encloses a central cavity. The germ cells of the miracidium give rise to germ-balls which, as growth proceeds, develop into daughter sporocysts. These germ-balls are observed to be usually attached to the wall of the mother sporocyst by fibrous strands of tissue until the late stages of their development. The body wall of a 5-weeks' old sporocyst has a cuticle several times thicker than that of younger sporocysts and fine transverse lines can be observed in it. All outlines are difficult to distinguish in these older specimens and germ-balls in various stages of development are present. At this stage there are relatively few germ cells present; many daughter sporocysts have matured.

Daughter sporocysts.—Young daughter sporocysts may be seen in the liver of infected snails in 5 weeks after infection with miracidia. These sporocysts are elongated and no outside cuticle can be observed nor is a body cavity visible.

As these daughter sporocysts become older, a cavity appears in which cercariae are developing. In this region the body-walls lose their cilia and a thin outer cuticle forms, inside of which a simple layer of cells which resemble those in the young mother sporocysts has developed. Small round cells with little cytoplasm are also present. Cercarial germ-balls, similar to the germ-balls in mother sporocysts that give rise to daughter sporocysts, are now forming so that cercariae may be born. These are the forms that emerge in puffs from the respiratory pore of the snail to attack man.

CERCARIAE

Cercariae have been observed to emerge, a few at a time or in puffs, from infected *Bulinus truncatus* snails in Egypt and *Physopsis africana* in Natal, South Africa. Laboratory-reared *Bulinus truncatus* snails were infected by Egyptians in the snail laboratories of the Egyptian Public Health Department and were found to begin emitting cercariae 8 to 9 weeks after being infected with miracidia. As they pass from the molluscan host they are very active. They are highly contractile and propel themselves by a sudden snapping vibration, forcing themselves upward with the forked tail foremost, which is more or less in opposition. They come to rest at or near the surface of the water and then slowly sink a certain distance into the water with the forked tail spread out at almost right angles to its short tail. A close-up view of a cercaria shows it to have powerful anterior and posterior suckers by which it crawls or applies itself to a surface. A cercaria was seen to shed its tail which continued a writhing action for some time after it was parted from its body.

MORPHOLOGY OF ADULT WORM

The morphology of the full-grown adult worms has been described by a number of workers. The sexes in both *Schistosoma hemotobium* and *Schistosoma mansoni* are separate. The male worm is flat and its edges curl up to make a groove in which the female is held. The female is longer, thinner, and weaker than the male. The male is between 10 mm. to 18 mm. long and 1 mm. broad whereas the female is anywhere from 8 mm. to 22 mm. long and 0.25 mm. broad. Anteriorly as far as the posterior sucker the body is conical. There is an infolding of the edges of the male worm to form the gynecophoric canal which extends almost the full length of the worm and in which the female is carried. The cuticle is covered with fine spines which are often clustered upon papillae. There are papillae on the suckers.

These papillae are more pronounced on the dorsal surface but the spines on the ventral surface are more numerous though finer. There are a few coarse papillae on the inside of the gynecophoric canal.

The anterior sucker is oval with a slight constriction into lips which will protrude in the living worm. The posterior sucker is larger than the anterior sucker and is funnel-shaped.

The digestive system commences at the mouth which is small and muscular. The spines about the oral sucker aid in its attachment to a blood vessel. The short esophagus, which has two dilations, is lined with glandular cells. It bifurcates to form two intestinal branches which have a serpentine course with some anastomoses between them. About the middle of the body these branches join and continue posteriorly as a single intestine. The male reproductive system is composed of four or five rounded testes.

Each testis is connected to a deferens which opens at the genital pore near the ventral sucker.

The nervous system consists of a dorsal ganglion and two nerves that pass the full length of the body. Fine nerve fibers also pass to the oral suckers.

The adult female *Schistosoma hematobium* is more frail than the male. Its body is somewhat flattened and less spiny than the male and its suckers are smaller. The gut and nervous system resemble the male. The ovaries are pear-shaped, lie just anterior to the junction of the intestinal branches, are joined by a common oviduct which widens into a uterus that opens into the genital pore located near the oral sucker. In the uterus will often be found numerous eggs which are capable of being fertilized when the female lies in the gynecophoric canal. The female leaves the male when fertilized and moves down a capillary as far as possible and lays egg after egg by waves of contraction of her body.

STRUCTURE AND BIOLOGY OF SCHISTOSOMA MANSONI

OVA

The ova of *Schistosoma mansoni* were obtained from the fresh stools of an infected Egyptian. A direct smear of the feces is put on a 3- by 1-inch slide and examined for the eggs. If none are found, then a flotation method is used which is as follows: A small portion of the feces about the size of a pea is emulsified in a saturated solution of table salt by shaking it vigorously in a test tube. This is then strained through a hundred-mesh wire screen into a conical Erlenmeyer flask, which is filled to the top with saturated salt solution. This is left to stand for 20 minutes, and the ova, if present, will rise to the top. The top layer is removed and examined under the low power of the microscope for ova. Any ova present will easily be found if the fluid is not

spread out too much and if one focuses on the top layer of the fluid and not on the glass slide.

The ova are fairly conspicuous and can readily be identified by their coarse postero-lateral spine which is solid for the greater part of its length. They range between 120 to 160 microns in length and 40 to 60 microns in breadth. There are larger and smaller ones also outside of these general limits.

MIRACIDIA

The miracidia of *Schistosoma mansoni* seek out a specific snail host, *Planorbis boissyi*.

SPORO CYSTS

The time required for the development of the intra-molluscan phases of *Schistosoma mansoni* are somewhat more rapid than *Schistosoma hematobium*, being about four to five weeks. The sporocysts in the digestive gland of this snail are similar morphologically to those of *Schistosoma hematobium*.

CERCARIAE

The cercariae of *Schistosoma mansoni* are fork-tailed and resemble those of *Schistosoma hematobium*, but for more detailed descriptions one should go to the special texts on the subjects. It is stated that those who are used to observing the swimming habits of these cercariae can identify or distinguish *Schistosoma hematobium* and *Schistosoma mansoni* by the rapidity and nature of their movements.

ADULTS

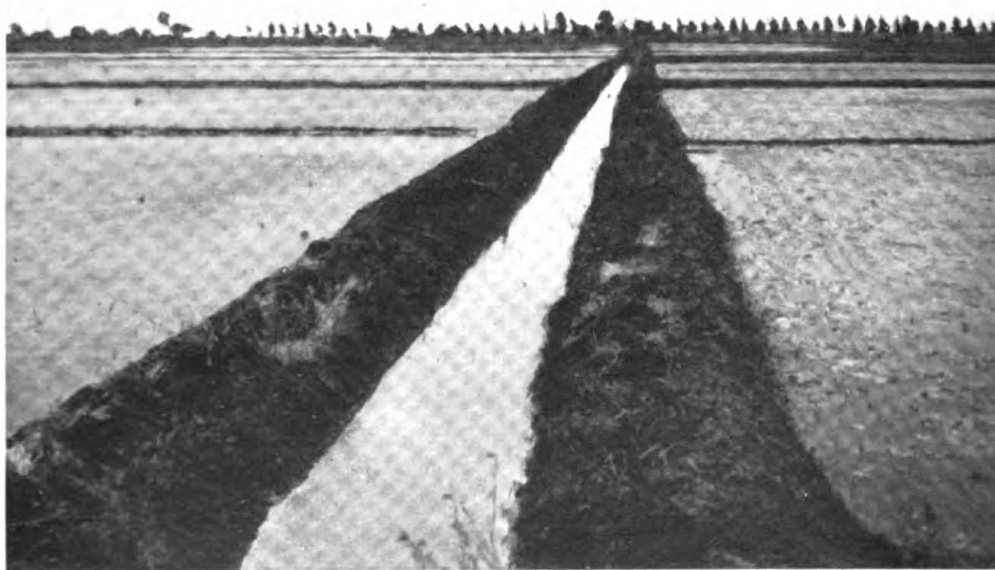
The adult *Schistosoma mansoni* worms are separate in sex and the male carries the female in the gynecophoric canal. The males are shorter and stouter than the female.

The adult *Schistosoma mansoni* blood flukes have a special predilection for the rectum.

PENETRATION AND MOVEMENT OF CERCARIA IN THE HUMAN HOST

In Egypt, cercariae may remain alive in fresh water up to 60 hours. Within that period of time they are capable of infecting a human being who has to work in the irrigation waters of that country. Egyptian fellaheen or farmers will tell you readily when they are being irritated by something in the water whenever they must work in it in a given locality. Innumerable exposures occur every day all over Egypt for varying periods of time from a few minutes to several hours, thus building up an enormous infestation in the population and resulting in one of the major causes of death in Egypt.

After the cercariae have penetrated the skin of a human being, they make their way by the lymphatics and blood vessels to the right heart. From there they pass to the lungs and return with the oxygenated blood to the left heart and then are distributed via the systemic circulation to all parts of the body. A large number reach the hepatic portal system and pass to the liver. Here growth of the worms takes place and at maturity they mate and pass in pairs against the flow of blood down the mesenteric veins and take up their final position in the venules around the colon (*Schistosoma mansoni*) or the bladder (*Schistosoma hematobium*).



2. Typical irrigation canal. In irrigating any field for cultivation, laborers must get in the water and their bodies are exposed to cercarial attack.

ECOLOGICAL STUDIES

It is necessary to understand the environmental factors which are responsible for snail distribution before control measures can be applied. The environment varies from province to province in Egypt and within them as well. A snail biologist can tell the presence or absence of snails in a canal by looking at it for he knows the favorable environment.

In such studies the following are to be noted :

“1. *Physical factors*.—Size and depth of canal, flow of water, consistency of bottom, flood of the Nile and chemical constituency of water.

2. *Biological factors*.—Presence or absence of other species, seasonal succession of aquatic weeds, fish, buds, algae.

3. *Climatic factors*.—Temperature of water, shade or light etc.”

All the foregoing factors have an influence on the distribution of snails.

CONTROL OF HUMAN SCHISTOSOMIASIS THROUGH THE TREATMENT OF ALL THE INFECTED POPULATION

Relatively large-scale treatment of schistosomiasis, mainly with sodium antimonyl tartrate, has been practiced in Egypt for the past 20 years.

The program is being conducted under the auspices of the Endemic Disease Section of the Ministry of Health, and includes not only schistosomiasis but other parasitic diseases as well.

The basic unit upon which the treatment depends is a mobile hospital with its own staff of specially trained doctors and technicians. At first these mobile hospitals were too heavily equipped and required several heavy trucks to move them over bad roads and often they could not reach many villages. Thus control, partly through treating the sick human schistosomiasis cases, broke down.

In 1945, light mobile units with a minimum of gear which could be carried in a small car or light pick-up truck had been designed. Villages and small habitations which previously were inaccessible can now be reached and mass human surveys and treatment programs carried out. There are about 120 of these mobile units in Egypt besides many permanent hospitals where the disease is treated.

Each unit is complete within itself, compounds its own prescriptions, and makes up its own intravenous solutions. There is a systematized routine whereby each patient is rapidly moved along through the sick line. They first receive two tickets, one of which is for the name, address, age, sex, serial number, days for reporting to the clinic and diagnosis, the other for the history of case, laboratory findings, physical examinations, treatments received, condition at end of treatment, and further follow-up if indicated.

SEASONAL VARIATIONS IN THE SNAIL POPULATION OF THE FRESH WATER STREAMS IN EGYPT

During the surveys of the molluscan fauna of the fresh-water streams in Egypt, the Snail Destruction Section of the Ministry of

Health of Egypt found that in certain months of the year the snails increased considerably in numbers and in others they were either few, absent, or dead, as evidenced from the empty shells collected. To determine the seasonal variation, the following environmental study was made, two typical canals being chosen in the Embab area, each harboring snails and weeds of common species. Approximately every $2\frac{1}{2}$ months, i. e., five times a year, the total number of snails both alive and dead were counted by dredging 1 meter of each stream and recording the numbers of every species. The snails were returned to their respective canals and the canals left untreated.

The study showed: (a) That there was a seasonal variation in the number of fresh-water snails;

(b) That there were two reproductive periods, one from October to December and the other from February to May;

(c) That there were two peaks in a year, one in May and another in December; and

(d) That at the time of the Nile flood the snails commence to die in great numbers and during the winter closure the hibernation stops the reproductive activities for the time being.

A CASE OF INDUCED SCHISTOSOMA HEMATOBIIUM IN MAN

The following is an account of the course of an infection illustrating both clinical and pathologic features. This experimental case, which was induced in a physician and a specialist in parasitology, afforded an unusual opportunity to follow through subjectively and objectively the complete course of a schistosomiasis infestation. He submitted to a large cercarial exposure about the first week of June 1944. It was contemplated that he was to be a source of ova for an experimental survey for new molluscan hosts in the United States of America.

Before leaving Egypt the patient had giddy, dizzy, nervous spells, aching muscles, some sweating, a loss of appetite, and irritability.

In a letter dated 27 November 1944, he stated as follows: "A most interesting and quite new development has come up just now. I had a sharp scrotal itching close to the groin and when I looked there were three or four little spots exuding serum. Being of an inquiring mind I put some of this serum on a slide. In the microscope I saw the eggs were passing right through my skin. So I * * * had a biopsy performed. They took out a piece near the groin on the scrotum which was 7 by 3 cm. and down through the true skin including the fatty tissue below. Free in the serum and blood of the incision they found one pair of worms *in copula*. As soon as we can run up these tissues for sectioning we will do so. I could not take a local anaesthetic as that might have disturbed the worms and ruined our experiment."

Excerpts from later letters are quoted next.

From letter of 8 December 1944: "I am passing a good many eggs via the stools."

From letter of 30 December 1944: "For the past 2 weeks I have almost more pain than I can take, fever, and great bladder distress. It all followed the two biopsies. Worms must have been disturbed and migrated *en masse* to the urinary plexus bringing with them fever and intoxication. Eggs (3,000 to 4,000), accompanied with blood appeared in one urination. Fever ran over 40° C. I am glad to be alive."

From letter of 9 January 1945: "I have been in bed since 16 December. I have had rather a close call and rough sledding. I had a fever up to 104.2° F. and great pain. Urinations every 20 minutes for 3 weeks and but little sleep during that time. Now things are settling down and the case has become chronic. No more fever, urinations free and spaced about two or three hourly, day and night. I sleep fairly well and life looks brighter again. I am shedding between 4,000 to 8,000 eggs a day in the urine. You see, when the biopsy was performed it disturbed the worms and they migrated *en masse* to the urinary plexus and came down all in a bunch giving me a big dose of poisons which brought on the fever and other acute symptoms. Now that the acute stage is over and the chronic stage has taken its place, I am much more comfortable. Urinations are not so frequent and not very painful but I am passing a bit of blood each time. * * * I do hope it has not all been in vain because I have suffered a lot."

From letter of 6 February 1945: "* * * according to number of cercariae which entered my body, if all lived, I have 223 worms and am passing over 12,000 eggs daily so you see it is not a light infestation. I have blood all the time in the urine and a good deal of bladder discomfort. It was a close call and I will not be sorry to cure it up."

From letter of 15 March 1945: "My case is chronic but distressing. There is constant bladder anxiety and a good deal of pain. Shreds of red blood cells and some bright blood are constantly passed. Thousands of eggs are present in each urination but my blood picture is about normal except for eosinophiles which run from 9% to 15%. I'll be glad to get rid of the infestation."

One course of antimony considerably alleviated the disease but the doctor was occasionally passing a few viable ova. He took a second course which seemed to improve him more and he was only passing dead eggs occasionally. He still had some hematuria at times. Now the subject is in the stage of proliferation and repair.

IDENTIFICATION OF SOME OF THE IMPORTANT SNAILS FOUND IN EGYPTIAN CANALS, THE NILE, AND OASES

Planorbis boissyi

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Four whorls. 2. Symmetrically rounded keel. 3. Young of species are provided with denticles. 4. Never found in upper Egypt and Fayum. 5. Vector of <i>Schistosomiasis mansoni</i> 6. Red blood. 7. Hermaphroditic. | <ol style="list-style-type: none"> 8. Foot more like <i>bulinus</i> (oval). 9. Does not grow more than 2 cm. in size. 10. Head and tentacles with eyes at base of them. 11. Foot cannot grasp as firmly as <i>bulinus</i> and hence is easily carried by current. 12. No umbilicus. |
|---|--|

Bulinus truncatus (*Bulinus truncatus* Audouin)

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Non-operculated. 2. Definite umbilicus. 3. Red blood. 4. Oval foot. 5. Head and tentacles. 6. Foot can grasp firmly. 7. Vector of <i>Schistosoma hematobium</i>. | <ol style="list-style-type: none"> 8. Fragile shell, gray color. 9. Left-handed aperture. 10. Found in both upper and lower Egypt and in the Oases. 11. Hermaphroditic. 12. Has epiphragm when dry. |
|---|--|

Planorbis mareoticus (*Gyraulus mareoticus* (Innes))

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Lower Egypt and Giza (very common). 2. Not vector of schistosoma. 3. Never grows as big as <i>boissyi</i>. | <ol style="list-style-type: none"> 4. Sharp keel. 5. Red blood. 6. Four whorls. 7. Hermaphroditic. |
|---|--|

Planorbis phillippi (*Gyraulus phillipi* (Monterosato))

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Lower Egypt and sometimes Giza. 2. Not a vector. 3. One-half as big as <i>boissyi</i>. 4. Unsymmetrical (one side like <i>boissyi</i> and other side is flat as if entire half had been sliced off). | <ol style="list-style-type: none"> 5. Has red blood. 6. Hermaphroditic. 7. Foot, tentacles and eyes same as <i>Planorbis boissyi</i>. |
|--|--|

Lymnaea caillaudi (*Lymnaea natalensis caillaudi* (Bourguignat))

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Large snail. 2. Right-handed aperture which is oval when wide open. 3. Umbilicus. 4. Prefers stagnant water somewhat stationary. 5. Large body spire. 6. Thin, short, tapering spire. 7. Columellar axis is covered with a shelly deposit. | <ol style="list-style-type: none"> 8. Foot is short and rounded posteriorly. 9. Eyes at inner base of tentacles. 10. Hermaphroditic. 11. Lymph is white. 12. Vector of <i>Fasciola hepatica</i> in sheep, cow, and buffalo. 13. Presence prevents raising of cattle in Kharga Oasis. 14. Speckled black pigmented foot. |
|---|--|

Lymnaea truncatula (*Fossaria truncatula* (Müller))

- | | |
|---|----------------------------------|
| 1. May be a vector of liver flukes in cattle and sheep. | 3. Umbilicus. |
| 2. Small spires. | 4. Found in all the Nile Valley. |
| | 5. White lymph. |

Succinea cleopatrae (*Succinea cleopatrae* (Pallary))

- | | |
|-------------------------------------|--|
| 1. Right-handed long oval aperture. | 4. Not known vector. |
| 2. Very fragile shell. | 5. Intermediate size between truncatula and caillaudi. |
| 3. White lymph. | |

Ampullaria ovata (*Pila ovata* (Olivier))

- | | |
|-------------------------------------|--|
| 1. Operculated snail. | 6. Body spine huge in comparison to rest of spine. |
| 2. Large species. | 7. Right-handed aperture. |
| 3. Definite umbilicus. | 8. Found in Nile Valley. |
| 4. White lymph. | |
| 5. Not a vector of schistosomiasis. | |

Lanistes bolteni (*Lanistes carinatus* (Olivier))

- | | |
|------------------------------|---|
| 1. Left-handed aperture. | 5. Not a vector. |
| 2. Large snail, operculated. | 6. Huge body spine in comparison to rest of spines. |
| 3. White lymph. | 7. Found in all the Nile Valley. |
| 4. Definite umbilicus. | |

Viriparus unicolor (*Viriparus unicolor* (Olivier))

- | | |
|---|----------------------------------|
| 1. Not a vector of schistosomiasis. | 4. Found in all the Nile Valley. |
| 2. Right-handed aperture. | 5. Umbilicus present. |
| 3. More whorls than Lymnaea and is larger and longer. | 6. Lymph is white. |
| | 7. Operculated (?). |

Cleopatra (*Cleopatra bulimoides* (Olivier))

- | | |
|--|---|
| 1. Intermediate hosts of single-tailed cercaria not affecting man. Transmissible to ibis, birds related to the herons. | 4. Host of a single-tailed cercaria known as <i>Distomatosa sonsino</i> and attacks dogs and birds but not man. |
| 2. Right-handed aperture. | 5. Colored stripes. |
| 3. Operculated, hinged. | |

Bithynia goryi (*Bulinus goryi* (Bourguignat))

- | | |
|--|---------------------------|
| 1. Small snail. | 5. Small snail. |
| 2. Young of this species are easily confused with <i>Cleopatra</i> . | 6. White lymph. |
| 3. Lack of color. | 7. Right-handed aperture. |
| 4. Operculated. | 8. Not a vector. |

Melania tuberculata (*Plotia tuberculata* (Müller))

Found in pockets in the Nile and the Dakhla oasis and in hot springs.

- | | |
|--|---------------------------|
| 1. Vector of single-tailed <i>cercaria pyramidum</i> and <i>cercaria distomotosa</i> . | 3. Non-operculated (?). |
| 2. End of spine is very sharp pointed, many whorls, dark brown or reddish color. | 4. Right-handed aperture. |
| | 5. Umbilicus absent. |
| | 6. White lymph. |

MONTHLY GROWTH MEASUREMENTS AND LIFE SPAN OF *BULINUS TRUNCATUS* AND *PLANORBIS BOISSYI* FOR CONTROL PURPOSES

The director and research workers of the Egyptian snail laboratories found that *Planorbis boissyi* lived 20 months and *Bulinus truncatus* 17 months. The monthly rate of growth was computed from the dead shells. The aquariums were large and well aerated, but did not allow the freedom of motion that snails find in nature.

Nine thousand young bulinus and 8,000 young planorbis snails of the same age were obtained and placed in 2 separate ponds. Each month 100 snails were picked at random and the monthly growth of the shells was measured and recorded.

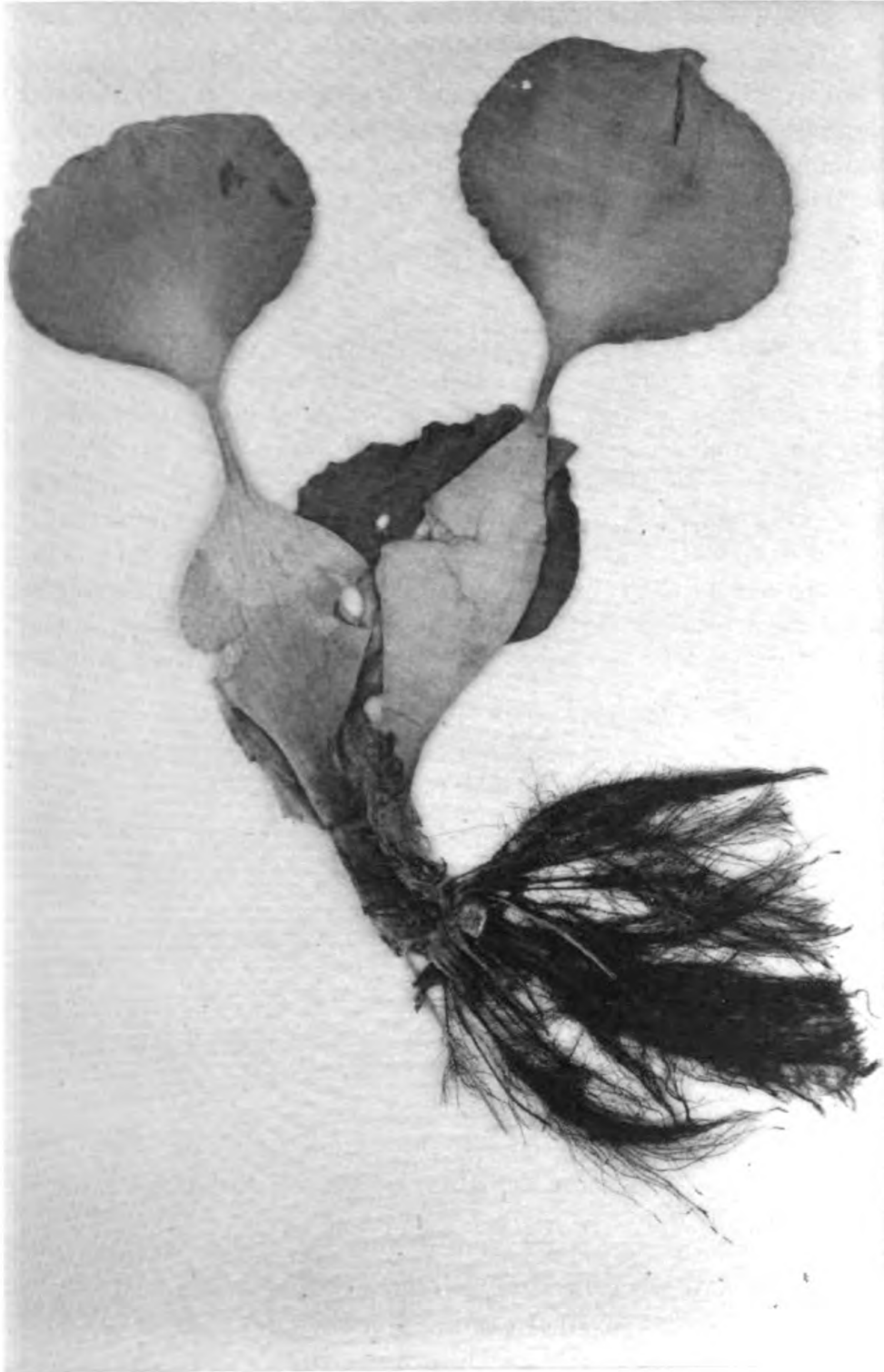
Bulinus lived for 11 months and reached an average length of 12.5 mm. at the end of this period. *Planorbis* lived for 18 months, the average greatest diameter at end of the period being 13.2 mm.

In view of the combined results of laboratory and environmental investigation, it was concluded the life span of the snails does not exceed 2 years.

Resistance of snails to drying.—At the approach of “winter-closure” each year, when the water is shut off in the canals of Egypt for 40 days, the snails hibernate by drawing their bodies into their shells, forming an epiphragm, waiting for the return of water. They may look dead to the ordinary observer but when water is returned to the canal they become active again.

Dr. C. H. Barlow finds that both species resist long periods of drying and has published two articles relative thereto: “The Effect of Winter Rotation of Water Upon Snails Involved in the Spread of Schistosomiasis in Egypt” and “Further Studies on the Revival After Drying of Snail Hosts of Human Schistosomiasis of Egypt.”

It was concluded that drying as a method of destruction of snails in Egypt is not practicable.



3. *Lemna gibba* (water lentil or duck-weed).

REVIVAL AFTER DRYING LARGE NUMBERS OF BULINUS AND PLANORBIS SNAILS

An experiment as to the effect of drying upon snails showed that planorbis revived after 10 months and bulinus after 12 months. The snails, upon revival, not only feed and resume normal activities but start laying numerous clutches of eggs in quick succession.

SELF-FERTILIZATION OF *PLANORBIS BOISSYI*

Bilharzial snails are hermaphroditic. The problem of exterminating a creature which has the capacity of self-fertilization is a very difficult matter since a single snail left by chance in a canal or a drain would be able to propagate the species. Laboratory experiments show they are capable of self-fertilization for many generations.

Snails were bred from a single clutch and young *Planorbis boissyi* were put at birth into separate containers for six generations. The period from birth and laying of first clutch varied from 42 to 116 days.

Snails are quite prolific. A snail can lay as many as 22 egg masses in 26 days totaling 236 eggs. Once they have reached sexual maturity they continue to lay for a number of months, then stop a while and start again.

GRASSES AND WEEDS FOUND IN EGYPTIAN CANALS UPON WHICH MOLLUSCS FEED

Bulinus truncatus feeds upon:

1. Potamogeton crispus (curled pond weed).
2. Polygonum serrulatum.

Planorbis boissyi feeds upon:

1. Panicum repens.
2. Paspalidium geminatum.

Other weeds that are food sources common to both snails:

1. Lemna gibba.
2. Eichornia crassipes.
3. Alternanthera achyranthoides.

Other weeds present in Egyptian canals which may be food supply of all types of molluscs:

1. Cyperus alopecuroides.
2. Potamogeton pectinatus (fennel pond weed).
3. Potamogeton americanus (pond weed).
4. Nymphaea lotus L. (white water lily).
5. Nymphaea coerulea (blue water lily).
6. Ceratophyllum demersum (hornwort).
7. Pistia stratiotes.
8. Eichornia crassipes (water hyacinth).
9. Typha angustata (weed mace or bull weed).



4. *Ceratophyllum demersum* (hornwort).

10. *Polygonum senegalense*.
11. *Phragmites communis* (common weed).
12. *Paspalum distichum*.
13. *Paspalidium geminatum*.
14. *Jussiaea repens*.
15. *Echinochloa stagnina*.
16. *Diplachne fusca*.
17. *Cyperus articulatus*.

These weeds are important in survey and control work in locating and destroying snails. The accompanying photographs of grasses taken from Egyptian canals upon which snails feed illustrate the type of food supply which the snails need.

SNAIL DESTRUCTION NOW IN PROGRESS IN EGYPT

Egypt is almost entirely a desert country, depending wholly upon a single source of water for its irrigation supply. Only a narrow strip of land along each side of the river is available for cultivation even when irrigated. At Cairo there is a widening of this strip into the Delta, which has been deposited through the centuries. Unlike many other countries which have a schistosome problem the area occupied by infected snails is comparatively small. In Egypt the possibility of killing the snails is relatively simple because the snails do not crawl out of the water to escape either poison or dredging, thus rendering them peculiarly open to attack. They do not have opercula which they can shut against poisons and retire into their shells. The water supply being under the control of the Irrigation Department makes possible a large number or measure of control over the breeding places of these snails. Other countries, which have a rain-water supply, are entirely helpless to control their breeding places. In the Far East there are many reservoir hosts for human schistosomes, making it almost impossible to eliminate the sources of pollution and infection. In Egypt, man alone harbors the adult schistosomes and man can be controlled to some extent. He can be educated and coerced into keeping the streams reasonably free from pollution.

During the years of 1943-45, good progress in snail destruction work has been made in Egypt. The work consists of two main parts: (1) The survey of the streams for snail hosts (the work in Giza Province, the Fayum, and Aswan has gone forward) and (2) The treatment of the streams found to harbor bilharzia snails. To accomplish this work required the organization and standardization of methods for the destruction of the snail hosts of schistosomiasis, the establishment of workshops for the making of nets and various implements for the section, which was accomplished, and the training of a field staff, i. e., engineers, overseers, heads of gangs, and snail collectors.



5. Canal untreated, with *bulinus* and *planorbis* snails in the grass.

THE SURVEY

The aim of the survey is to note accurately the location and the number of snails in a canal or a drain. Often a stream several kilometers in length harbors snails only in the last kilometer or so, the rest being free from snails. The subsequent treatment of the stream was therefore confined to this portion of the stream.

An overseer, after receiving his area, which as a rule consists of 15,000 to 20,000 feddan (one feddan is 1.02 acres) examines its streams by making stations on both banks at intervals of about 30 to 50 meters. At each station three dips are taken by nets and the snails collected at every dip are recorded in the respective column in survey record books. Notes are also taken about other species of snails and weeds; length, width, and depth of streams, etc. The survey records are so arranged that the results of successive surveys and treatments of the same stream can be noted at a glance.

THE TREATMENT

The treatment consists essentially of: (1) Clearance of weeds and snails by mechanical methods such as nets, diggers, and manual labor; and (2) Sulfation.

Clearance.—This operation is executed by hired labor assisted by a number of heads of gangs, snail collectors, and the overseer of the area who supervises the work. It is preferably done at low water or when the canal is dry or moist. After closing the intakes of the stream the laborers use the “fas” (short-handled heavy-bladed hoe) and a small native-made sickle, tools with which they are very familiar, and their naked hands, which are more useful than implements in taking out the sticky, muddy silt. The only additional implement required is a net for collecting weeds, plant refuse, snails, and ooze. The nets are of three sizes of mesh: Ordinary chicken-wire, wire mosquito-netting having 3 meshes to 1 cm., and wire mosquito-netting having 9 meshes to 1 cm. “Three men went ahead with sickles and diggers and cut away weeds and grass and aligned the canal banks. Then men followed lifting out mud and weeds by hand. One man followed them using a chicken-wire net to remove the coarse stuff they left. Following him came two men with coarse nets who removed all the large snails, fine weeds, scattered leaves, masses of algae, and plant refuse; following these came two men with fine nets who removed all the small floating particles, the tiny snails, and ooze. Most of the egg-clutches were caught by the fine nets. When the work was well done, the last two



6. Sickles, hands, fas, nets are employed in this order in all organized canal clearance crews for snail destruction.

men left the canals clean and well aligned and ready for the return of the water."

Sulfation.—Before sulfation of a stream certain preparations and precautionary measures are taken. If a stream is weedy it is cleared first. This makes the dragging of the bags of copper sulfate possible and also decreases the absorption of copper sulfate by organic matter and weeds. The irrigation department authorities are notified in order to arrange for water supply on the required date, and notice is



7. Canal cleared and sulfation begun to kill the snails.

given to the Omdah to warn the population not to use the sulfated water. The intakes of streams are closed as well as the openings into the adjoining streams, then sacks of copper sulfate attached to the middle of a rope are dragged by men from opposite banks of the stream. The concentration used varies between 15 to 30 parts per million and this is calculated in proportion to the water content of the stream in cubic meters. After sulfation, samples of water are examined to verify the concentration. From 4 to 5 days after clearance and sulfation, a check survey, known as "Survey after Treatment" is made in order to note the percentage of snails killed. An annual schedule of work for both operations mentioned has been worked out, based on a study of the life-cycle of snail hosts and weeds.

The months of April and October are given to surveys, when reproductive activities and growth of snails are in full progress, and the rest of the year to treatment.

Irrigation rotations.—In sulfating the streams, irrigation rotation periods are observed strictly. At the beginning of each irrigation season a table is published by the irrigation department showing the dates of the rotations for each canal and its branches. This information helps to determine when to sulfate the canals at a period which is not used for irrigation. Until recently, it was the practice to sulfate the streams after having filled them with water up to a certain level. Lately, this method was modified by clearing the sides first and then sulfating at low water. This modification proved to be advantageous over the first method as it prevented the farmers using sulfated water when it was not their turn, and saved copper sulfate to a large extent.

Weeds.—Of the aquatic weeds found in canals the most troublesome is *Potamogeton crispus*. During the winter months very little of this weed is found in the streams but in the spring it commences to propagate vegetatively by means of rhizomes and winterbuds, becoming very abundant in March, April, and May. These months coincide with the egg-laying period of bulinus and planorbis snails which lay their eggs on the leaves of this weed where the young snails feed after hatching. The control of potamogeton is difficult because cutting keeps the stream clear only temporarily and the weeds soon grow again as long as the rootstocks remain in the mud. At present, an attempt is made to get rid of this weed by removing the root stocks by manual labor from the infested streams.

TREATMENT (DOSAGE) USED IN EGYPT

The treatment now used in Egypt is as follows: Solutions of sodium antimonyl tartrate are made up in such a way that 1 grain is contained in each cubic centimeter of sterile water. A total of 22.5 grains given intravenously constitutes a "course" for an adult of 60 kilograms. Intravenous treatment is given the patient every other day.

The first injection will amount to $\frac{1}{2}$ to 1 grain depending upon the physical condition of the patient. The second injection may be $1\frac{1}{2}$ grains. Thereafter, 2 grains are given every other day until the "course" has been completed. Children and young adults receive about one-half this amount of medication, spaced as stated.

Most of the patients exhibit little or no reaction immediately following the injection. They are ambulatory and usually leave as soon as they have received their injection to return to their work or their village home.

This treatment has reduced the severity of the disease in Egypt but it has not reduced the infection rate. On return to work, a patient can become reinfected in a few minutes. Then the acute symptoms begin again with disability and destruction of tissue.

TREATMENT USED IN SOUTHERN RHODESIA

Intensive treatment of schistosomiasis with sodium antimonyl tartrate, speeding up the procedure as used in Egypt, has been successfully carried out in a series of 100 cases. Two grains of sodium antimonyl tartrate are dissolved in 10 cc. of 5-percent dextrose solution. The injection is given intravenously at the rate of 2 cc. per minute. It is of paramount importance to give the injection slowly as indicated. This dose is given three times daily for 2 days. If given properly this dosage is lethal to the blood fluke but is not poisonous to the patient.

TECHNIQUE FOR MAKING PERMANENT SLIDES OF CERCARIAE

Cercariae can be stained by different methods to show their morphological characteristics. The following method can be used to make permanent slides of cercariae:

1. *Fix* in hot lactophenol solution (equal parts of lactic acid, phenol, glycerin, and water) by adding a few drops of this solution, heated almost to boiling point in a test tube, to a watch glass containing living cercariae in water.
2. *For staining* purposes it is only necessary to add a diluted dye to the lactophenol solution in the watchglass, and allow the cercariae to stain for 12 to 24 hours. Over-staining may be reduced by adding a little more lactophenol solution.
3. *Mount* the stained cercariae in lactophenol-gum solution prepared as follows: Dissolve 3 parts Tragacanth and 1 part Acacia in 100 parts water by boiling, add an equal amount of lactophenol solution, and filter.

The stains used are: (1) Alcoholic solution of borax-carmines prepared by making a concentrated solution of carmine in borax solution (3 percent carmine to 4 percent borax) by boiling for one-half hour or more, diluting with about an equal amount of 70 percent alcohol, allowing to stand some time, and filtering; or (2) Dilute Delafields hematoxylin.

For more detailed description of the structure within the cercaria itself such as the salivary gland, excretory system, body "flame" cells, nervous system, and genital system, see Faust, Porter, Barlow, Azim and others.

SUMMARY OF HUMAN SCHISTOSOMIASIS IN EGYPT AND ITS CONTROL

This report traces the historical high lights of the search for knowledge about schistosomiasis in Egypt, deals with the biology of the disease as found there, and brings us up-to-date on the control work as it now exists in that country.

Schistosomiasis is the second most important disease in Egypt for it affects about 9,000,000 people there. The population of Egypt is now about 18,000,000 people. For the last 25 years, treatment and control work has been in progress. Although the treatment has been responsible for the disappearance of the serious complication, yet the incidence remains the same because of reinfection.

The etiologic agent of schistosomiasis in Egypt is a trematode, *Schistosoma hematobium* which lodges in the venules around the bladder and *Schistosoma mansoni* which lives in the venus plexus of the rectum.

The cycle of human schistosomiasis in Egypt is one which is comparatively simple and direct. Man is the primary or definitive host and an aquatic snail is the intermediate host.

There are two species of fresh-water snails acting as intermediate hosts of human schistosomiasis. *Bulinus truncatus*, the intermediate host of *Schistosoma hematobium* is spread over the whole of Egypt. *Planorbis boissyi*, the intermediate host of *Schistosoma mansoni* is localized in the Nile Delta.

Eggs from man, the definitive host, fall into the water and burst, liberating the miracidia, the first larval form of the worm. This form swims freely in all directions and seeks the intermediate host, an aquatic snail. It must find the specific snail within 8 hours or it dies.

Once the miracidia are inside the snail they develop into sporocysts, daughter sporocysts, followed by the evolution of many cercariae. These escape from the snail and swim freely in the water.

Infestation is not conferred by drinking polluted water but from working in it, the cercaria boring through the unbroken skin of any person who presents himself. The cercariae must find a human being within 48 hours or they die. Entrance is accompanied by a burning itch and resultant dermatitis. Once inside the body, the cercariae go to the liver and mesentery by way of the circulation. In the liver or mesentery they grow to adult worms and await their mates. The growth to adulthood in the liver and mesentery is accompanied by fever and acute pathological changes such as cirrhosis, and other local changes. These changes probably set up secondary changes in the spleen and other organs. When the mate arrives the two sexes remain *in copula* and migrate to their ultimate site against

the flow of blood down the mesenteric veins to the venules around the colon or bladder.

One species goes to the venules about the bladder, the other species goes to the vessels around the colon. In their chosen sites the female worms lay their eggs which escape into the bowel or bladder and pass out in the stools or the urine. There is loss of blood due to its digestion by the adult worms and due also to the escape of free blood during egg penetration.

One of the most important features in the campaign against schistosomiasis is the destruction of the snail hosts which carry the disease to man. Surveys are carried out for the purpose of mapping all areas where intermediate snail hosts exist and propagate. When this is effected the treatment and clearance of canals and streams can economically be carried out.

The program of snail surveys and control in Egypt is as follows: (1) Survey of streams for snails; (2) Clearance of canals by mechanical means; (3) Copper sulfate molluscicide; (4) Drainage of canals and swamps; and (5) Canal alternation.

Snail destruction in Egypt does not take into consideration any of the factors of human treatment but confines itself entirely to the destruction of the appropriate snail carriers.

The snails live in the main irrigation canals and drains and their branches. They are strictly aquatic and non-operculated, thereby differing from the snails which carry schistosomiasis in the Far East. This makes the killing of the snails very much simpler since the snails will not crawl out of the water to escape either poison or dredging.

The treatment of canals and drains consists essentially of: (1) Clearance of weeds by mechanical means; and (2) Sulfation by means of copper salts.

Clearance.—The work consists in the removal of weeds and the cleaning out of the fresh-water canals and drains by mechanical means and use of/or "fas" and nets. This is preferably done when the canals are only moist or almost dry or at the low-water period of irrigation in Egypt. The hand-nets that are used are covered with either coarse or fine steel gauze and provided with stout wooden handles. When a gang of men is doing clearance, the first men uproot the vegetation from the bottom and sides of a canal with hoes and hands. Those following dip out floating snails and other coarse debris with coarse nets. The top layer of ooze which harbors snails and eggs is removed with the fine nets.

Sulfation.—Copper sulfate is used in a concentration of from 15 to 50 parts per million and left to act for at least 3 to 4 days. Sulfation is only done in streams which are cleared of vegetation in order to minimize the absorption of the chemical by organic matter and to

facilitate the dragging of sacks of copper sulfate through them. The amount of sulfate required for the volume of water to be treated is filled into sacks of 10 kgs. each, which are tied to the middle of a rope and dragged along the stream by two men placed on opposite banks of the stream. The men take good care to distribute the copper sulfate evenly and judge the results by the blueness of the water. Concentration is also chemically estimated from samples taken.

Recently a method of weed and snail destruction by use of a flame gun was tried out but so far has proven to be a failure as it only burns off surface weeds and will not kill snails buried in the mud.

The value of the actual treatment of human schistosomiasis in Egypt should in no sense be underestimated as a practical means of control of this disease, as this measure, though a Herculean task, tends definitely to widen the gap between the number of infected individuals and the snails. At the same time the attack upon the snail is being constantly enlarged, intensified, and widened to reduce the snail population, thus breaking the link in the biologic chain of the disease at many points.

There are, however, many factors constantly operating at all times to weld this biologic chain together where it is being broken. There is the constant shifting about of the actively sick bilharziasis subjects shedding eggs in areas where treated and non-sick individuals live and work; incompetent, lackadaisical field workers failing to do good field surveys and control work on snails. Experiments have also shown that the snail alone is very prolific and anything that tends to affect its environment causes it to lay hurriedly many clutches of eggs to maintain its species. The foregoing factors relating to the prevalence of schistosomiasis together with insanitary habits of the populace, lack of sanitary installations, religious traditions of the Moslem to proscribe the washing of urethral and anal openings with water after urination or defecation, all of which when linked to each other, serve to maintain bilharziasis as practically the most universal disease in Egypt.

CONCLUSIONS

The present methods of control leave much to be desired.

New molluscicides must be found. Cawston of Durban, South Africa found that the roots of the tree, *Trephosia macropoda*, when put in among live snails would soon kill them. It is thought that it is the oil of wintergreen in these roots that is the molluscicide. Archibald in the Anglo-Egyptian Sudan suspects that an active principal in the nature of a saponin found in the berries, kernels, bark, branches, and roots of the tree known as the *Balanites aegyptica* is lethal to

molluscs, miracidia, fish, and tadpoles. The *Balanites aegyptica* has a wide distribution in the Sudan, flourishing in its arid regions. These and other molluscicides now in preparation should be experimented with in research laboratories and given extensive field trials.

New techniques and therapeutic agents for treatment of the individual must be developed. The new techniques for diagnosis with cercarial antigens and mass treatment as advanced by Aleves and Blair of Southern Rhodesia will speed up the treatment of a greater number of human cases.

Equipment for the filtering of water into the major and minor canals could be developed to prevent further influx of snails or eggs from the main sources. Sanitary installations for disposal of human excreta should be provided everywhere. Appropriate shoes or boots as a health protective measure should be provided for all children so that future generations will be wearing them.

Engineering, medicine, and statesmanship must join hands wherever this disease exists to attack the problem on a regional basis rather than within the restricted lines of a political frontier.

I wish to express sincere appreciation to Egypt's Ministry of Public Health and the directors and research workers of its Snail Destruction Section for their invaluable assistance in acquainting me with their public health problems, especially schistosomiasis. Also, acknowledgement is made to the distinguished group of teachers and researchers who through long years of patient investigation have laid the foundation for our recent progress in the study of the larval trematoda found in molluscs.

REFERENCES

- KHALIL, M. (1924) The History and Progress of Anti-Ancylostomiasis and Anti-Bilharziasis Work in Egypt (Report by Minister of Interior Egypt, Government Press, Cairo).
- KHALIL BEY, M.; and AZIM, M. A.: Introduction of schistosoma infection through irrigation schemes in Asswan area, Egypt. *J. Egyptian M. A.* 18: 371-377, June 1935.
- KHALIL BEY, M.; and AZIM, M. A.: Further observations on introduction of infection with *Schistosoma hematobium* through irrigation schemes in Asswan Province. *J. Egyptian M. A.* 21: 95-101, March 1938.
- ONSEY BEY, DR. ANIS (1936) Splenomegaly in Egypt Associated With Schistosomiasis (Extract du volume des Comptes Rendus, Third International Congress of Pathology, Athens 1936).
- KHALIL BEY, M.; and AZIM, M. A.: On history of antibilharzial campaign in Dakhla Oasis. *J. Egyptian M. A.* 21: 102-106, March 1938.
- ONSEY BEY, DR. ANIS (1938) Rare Tumor Formations Associated With Bilharzial Infections (Reprint from a book: "La Semaine De L'Egypte Pour La Lutte Contre Le Cander", 30 November 1938).
- PORTER, ANNIE (1938) Larval Trematoda Found in Certain South African Mollusca (The South African Institute for Medical Research, Johannesburg).

- BARLOW, C. H.: Seasonal incidence of infestation of snail hosts with larval human schistosomes. *Am. J. Hyg. Sect. D.* 30, 73-81, November 1939.
- McMULLEN, DONALD B., REZIN, PAUL F., and ALLISON, LEONARD N. (1940) Swimmers Itch. Distribution in Michigan on Observations on Its Control (Stream Control Commission, Lansing Michigan, Feb. 1940).
- AZIM BEY, M. ABDEL: First Annual Report, Bilharzia Snail Destruction Section, 1942, Ministry of Public Health, Colra, Government Press, Bulaq, 1945.
- BLAIR, DYSON; and ALEVES, WILLIAM (1945): Diagnosis of Schistosomiasis using a cercarial antigen in an intradermal test, Salisbury, Southern Rhodesia.
- ALEVES, WILLIAM (1945) Intensive treatment of Schistosomiasis with Antimony (South African Medical Journal, May 26, 1945).
- CAWSTON, F. G.: Some unfamiliar aspects of bilharziasis. (South African Medical Journal, August 25, 1945, Vol. 19, No. 16, p. 293.)



THE CLINICAL USE OF STREPTOMYCIN

The antibiotic agent, streptomycin, appears to possess therapeutic possibilities which deserve further clinical investigation. No serious irreversible toxic effects have been encountered from its use for 45 patients suffering from a variety of infections owing to organisms sensitive to its action. Included in this report are eight cases of bacteremia, in six of which recovery occurred. Doubtful results were obtained in two cases of undulant fever associated with bacteremia. Good results were obtained in 10 or 13 cases of moderately severe and severe infections of the urinary tract owing to a variety of pathogenic organisms. Of five cases of infection involving the tracheo-bronchial tree, satisfactory results were obtained in four. Included in the report are four cases of syphilis in which it is doubtful whether treatment with streptomycin was effective although the amount of streptomycin administered was small. In the group of miscellaneous infections treated with streptomycin are examples of typhoid fever, undulant fever, osteomyelitis, cellulitis, peritonitis, cholangitis, meningitis and ozena. In some infections, the results could be considered satisfactory; however, further clinical studies must be completed before final statements can be made concerning the efficacy of streptomycin in other of these infections.—HERRELL, W. E. and NICHOLS, D. R.: Clinical use of streptomycin; study of 45 cases. *Proc. Staff Meet., Mayo Clin.* 20: 449-462, November 28, 1945.

DEXTROCARDIA WITH SITUS INVERSUS

Report of Eight Cases
With a Review of the Literature on Dextrocardia

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Dextrocardia with situs inversus is a congenital anomaly which occurs more frequently than the textbooks mention. In most textbooks the condition is given one short sentence and called a rarity, or no reference at all is made. The purpose of this article is to bring attention to the subject of dextrocardia, particularly dextrocardia with situs inversus.

A REVIEW OF THE LITERATURE

Maude Abbott in 1936 (1) compiled 1,000 cases of congenital cardiac disease proven at autopsy, and reported 29 cases of "isolated" dextrocardia. She used the term "isolated" to indicate a congenital dextrocardia occurring by itself, that is, without any other coexisting congenital anomaly other than cardiac. Eleven of these cases were true dextrocardia with situs inversus, 10 were dextrocardia without situs inversus but with inversion of the cardiac chambers, and 8 were dextrocardia without situs inversus and without chamber inversion.

Moffet in 1915 (2) reviewed all previously reported cases of either congenital or acquired dextrocardia. Approximately 115 cases were reported in the literature; the first case was mentioned in 1649. Most of the cases reported were given as clinical diagnoses without autopsy or other confirmation. No mention was made of the types of dextrocardia found.

Jaccard in 1920 (3) again reviewed the literature. He noted that the first case of dextrocardia with situs inversus, proven at autopsy, was described by Pope in 1882. In the literature from 1887 to 1920 Jaccard found 61 cases of true dextrocardia proven at autopsy, but again no mention was made as to the number of cases of each type. He also stated that a frequent concomitant finding at autopsy was stenosis of the pulmonary artery and interventricular septal defect. The belief was expressed that there was some familial tendency to dextrocardia and that it occurred predominantly in males. Jaccard mentioned as further diagnostic aids that individuals with situs inversus were more often left-handed, and the right testicle was descended farther than the left. These statements were not substantiated in this present study.

EMBRYOLOGY

The mammalian heart is formed of mesodermal cells which unite into two endothelial tubes which then unite to form the normally placed heart. Even before the bilateral cardiac halves unite, each is marked by two constrictions which indicate the future regions marking off atrium, ventricle, and bulbus. Between the stages of 7 to 16 somites, the cardiac tube grows faster than the pericardial cavity in which it lies, and as a result the heart is compelled to bend. The entire heart tube is thrown into a simple spiralled S, the chief early flexure is to the right and through it the bulbus and ventricle bend into a U-shaped loop. At the same time the atrium shifts cephalad with the sinus venosus, both taking a dorsal and cephalic position. These changes cause an essential reversal of the original relations of the primitive parts of the heart. Originally the heart lies high in the cervical region, but lengthening of the pharynx and other structures causes a relative recession to the thorax. When the diaphragm reaches its final position, the heart rotates so that the ventricles become caudal to the atria.

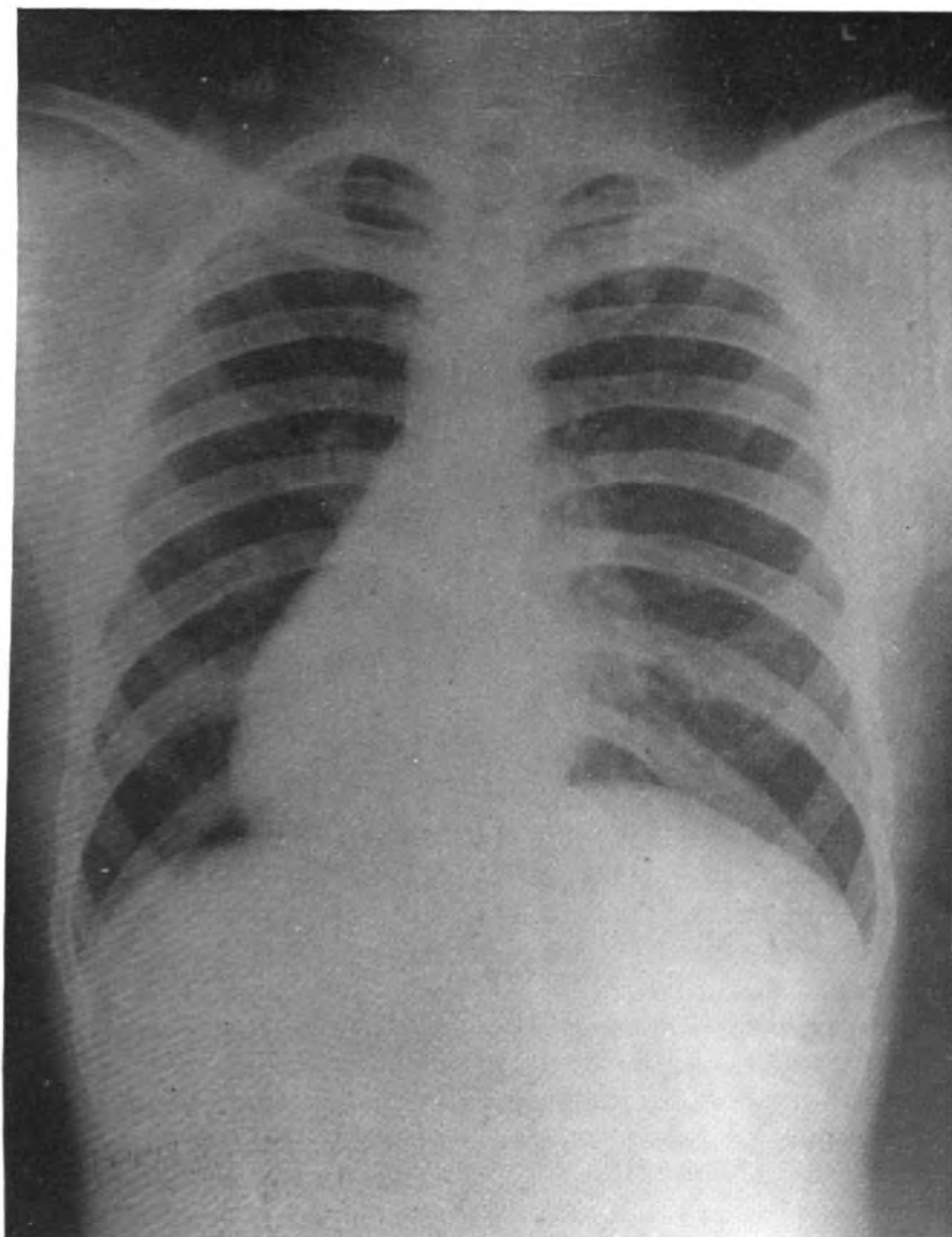
The four heart chambers and the valves are formed by the growth of septal walls. This development occurs simultaneously and is completed in an embryo of 2 months (4). What causes this process to be altered so that dextrocardia and chamber inversion occur along with situs inversus is unknown. It is thought that some defect exists in the primordia, but this could only be demonstrated by showing a familial tendency to dextrocardia and situs inversus.

CLASSIFICATION

Congenital dextrocardia, according to White (5), can be divided into two main types, each of which occurs with equal frequency.

1. The heart is merely rotated and lies in the right side of the chest. There is no transposition of the cardiac chambers or great vessels. The left chamber lies to the left and is anterior while the right chamber lies to the right and is posterior. The apex is formed by the right ventricle or by the right side of the common ventricle. In this type of dextrocardia there is usually, if not always, some other congenital anomaly or defect present. The prognosis depends upon this anomaly and not the dextrocardia itself. Jaccard found that these anomalies were usually stenosis of the pulmonary artery and interventricular septal defect.

2. (a) Transposition of the cardiac chambers marks the type. The right border of the heart and the apex are formed by what



1. X-ray photograph of a case of dextrocardia with situs inversus.

would normally be the left chambers, the left side thus being formed by the right chambers. The great vessels are also transposed, and heterotaxy or transposition of the abdominal viscera also occurs. In this "mirror type" of dextrocardia usually no other congenital defect is present. Life or activity is not affected since functionally the circulation is only reversed.

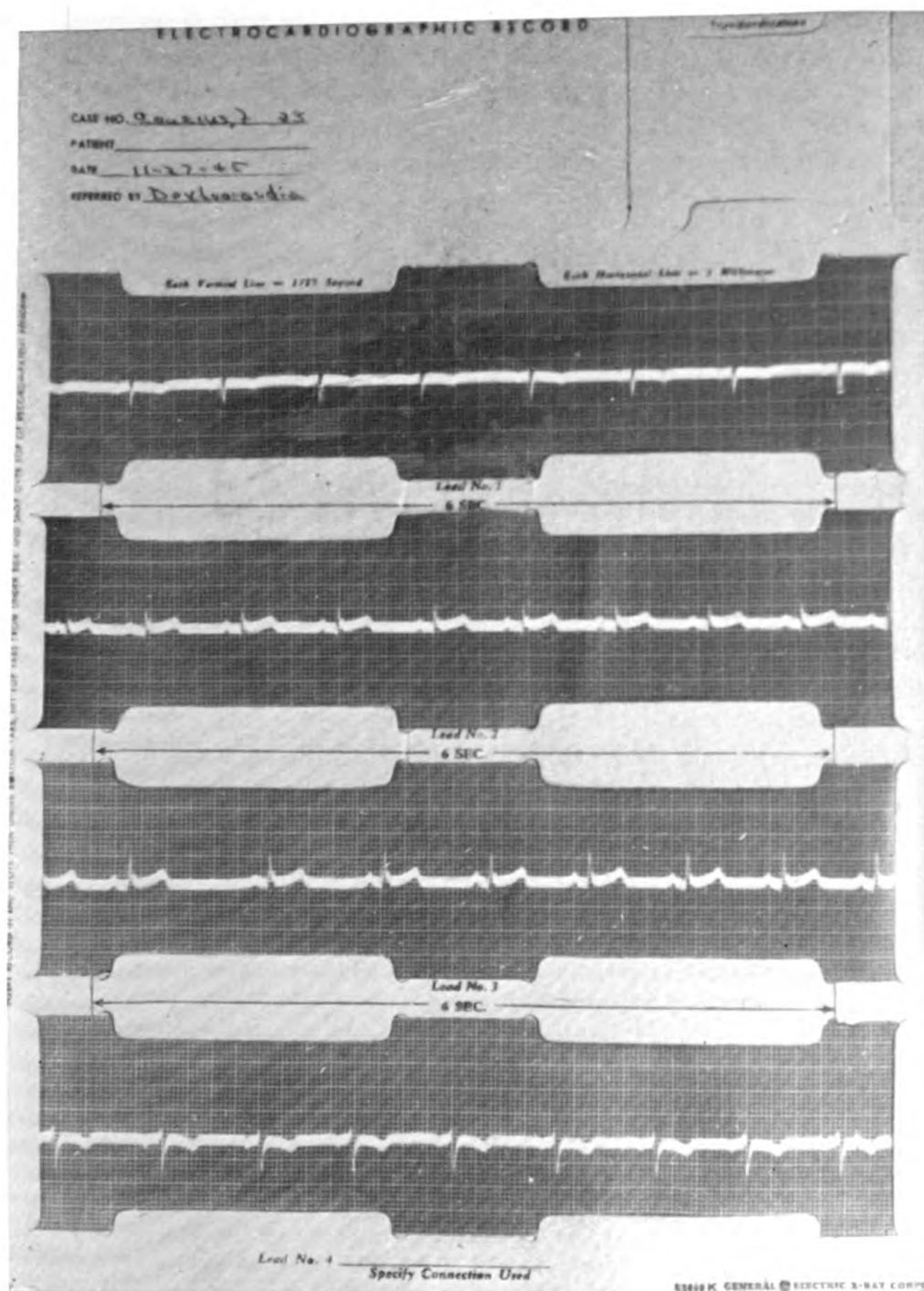
(b) Dextrocardia with only partial situs inversus almost without exception is associated with other grave cardiac anomalies. These patients usually are stillborn or do not survive infancy. Cyanosis is the usual sign. The absence of the right axis deviation in the electrocardiograms indicates serious cardiac anomaly.

DISCUSSION

In the process of performing physical examinations, dextrocardia can easily be overlooked (6). This is especially true in the case of the thin-chested individual who has apparently normal heart sounds at the fifth left interspace. The eight cases of dextrocardia with situs inversus reported here were found in the process of routine physical examinations conducted at the Office of the Port Medical Representative, War Shipping Administration, New York City. Several of these cases were noted on clinical examination as dextrocardia, but most of them were revealed by routine 35-mm. film roentgenograms of the chest. The eight cases reported were reexamined by electrocardiography and fluoroscopy during the oral ingestion of barium; four additional cases were found by 35-mm. film radiograph, but were not included since they were not so reexamined.

The eight cases of dextrocardia with situs inversus were found in the first 100,000 35-mm. films taken on different individuals, making an incidence of 0.008 per thousand. If the four unconfirmed cases are included, the incidence would be 0.012 per thousand. The ages of the men varied from 20 to 42, the average age being 31. Physical examination revealed no signs or symptoms. Indeed, most of the patients were surprised to learn that they were medical rarities and stated that they had not been handicapped in any way. Blood pressure, pulse rate, height and weight, and urinalysis were normal in all cases. No cyanosis or clubbing of the fingers was noted. No patient complained of syncope.

Fluoroscopy showed the cardiac apex to the right, elevation of the left diaphragm, and the stomach directed to the left (fig. 1). Electrocardiograms showed all complexes inverted in lead 1; lead 2 was comparable to lead 3 of the normal electrocardiogram, and lead 3 to the normal lead 2 (fig. 2).



2. Electrocardiogram of a case of dextrocardia with situs inversus.

SUMMARY

1. The occurrence of eight cases of dextrocardia with situs inversus is reported with a review of the literature on dextrocardia.

2. Attention is called to the fact that this rare congenital anomaly does occur, and without the presence of any signs or symptoms.

3. The fluoroscopic and electrocardiographic findings in the eight cases are given.

REFERENCES

1. ABBOTT, M. E.: Atlas of Congenital Cardiac Disease. American Heart Association, New York, 1936. p. 58.
2. MOFFETT, R. D.: A Revision of the List in the Paris Theses (1912) by Culver-Petrasco. New York Academy of Medicine, March 1915.
3. JACCARD, C.: Paris Theses, 1920.
4. AREY, L. B.: Developmental Anatomy; a Textbook and Laboratory Manual of Embryology. 3d edition. W. B. Saunders, Philadelphia, 1938. pp. 290-295.
5. WHITE, P. D.: Heart Disease. 2d edition. The Macmillan Co., New York, 1937. p. 205.
6. STROUD, W. D.: Diagnosis and Treatment of Cardiovascular Disease, Vol. 1. 3d edition. F. A. Davis Company, Philadelphia, 1945. pp. 838-840.



TOXIC EFFECTS OF DDT IN MAN

Author's summary.—Exposure of two subjects for 48 hours under special conditions (oily surface, large skin areas exposed, high ambient temperature, and relative humidity) produced definite toxic effects, including an increase of erythrocyte destruction (siderocytosis), a decrease in the mean corpuscular hemoglobin, an increase in reticulocytes, a slight fall in hemodynamic index, a diminution of polymorphonuclear neutrophil leukocytes accompanied by the appearance of immature white cells, the appearance of indoxyl sulfate in the urine, tiredness, heaviness, and aching of limbs, diminution of some reflexes, unilateral slight impairment of hearing, transient "yellow vision" (one subject), muscular fibrillation (one subject), peripheral patchy anesthesia (one subject), weakness of the legs, and a curious apprehensive mental state. A return to normality took between 26 and 33 days.

The significance of these findings is discussed, the relative merits of the examinations used are considered in relation to the control of DDT intoxication, and the danger of DDT in the presence of oil is emphasized.—CASE, R. A. M.: Toxic effects of 2,2-bis (*p*-chlorophenyl) 1, 1, 1-trichlorethane (D. D. T.) in man. Brit. M. J. 4432: 842-845, December 15, 1945.

CANCER IN THE NAVAL SERVICE¹

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Experience at the United States Naval Hospital, Brooklyn, N. Y., has led to the impression that illness from cancer in the naval service is of greater proportions than is generally realized. This study is an effort to calculate (1) the number of cases of cancer which may be expected to be diagnosed per year in the Navy and Marine Corps of about 3¼ million men; and (2) the prevalence of cancer in these services, i. e., the number of cases diagnosed and treated during a year. In addition, incidence and prevalence of cancer in the peacetime naval service have been estimated; these figures are a forecast of the problem of cancer and the allied diseases as it will probably present itself in the naval service through the next 30 years at least.

On the basis of extensive surveys by the United States Public Health Service, Dorn (1), (2), (3) recently studied the rates of illness from cancer in the United States. He finds that about 230 new cases of cancer are diagnosed during the course of a year among each 100,000 white urban residents, and that, among the same number, 430 are either under treatment for cancer or under observation because of a previously treated cancer. Of this number, 380 actually have malignant neoplasms. For several reasons this analysis is limited to white males. While it appears that illness rates for cancer are lower among Negro males than among white males in the civil population, a lower susceptibility among Negroes cannot be assumed unless it can be demonstrated that the same proportion of people having cancer in both races receives medical care. The difference in rates for the two races, if one exists, is rendered even less significant by the small proportion of Negroes in the Navy and Marine Corps. Females have been excluded because the incidence of cancer would not be expected to be statistically important in a group so numerically small and so uniformly youthful.

In table 1 are summarized those of Dorn's data which form the basis of this analysis. It is worthy of note that, for the most part, the figure for incidence in each 5-year age group is approximately from 55 to 60 percent greater than the figure in the preceding group. In

¹ Received for publication 8 October 1945.

other words, the average increase in incidence rates is between 11 and 12 percent per year of life. It would seem that the susceptibility of white males to cancer increases at a uniform rate as they grow older.

TABLE 1.—Incidence and prevalence rates of cancer per 100,000 white males in the United States

Age	Incidence	Prevalence	Age	Incidence	Prevalence
Under 10.....	7.9	10.3	45-49.....	213.9	321.4
10-19.....	10.4	15.3	50-54.....	367.8	528.2
20-24.....	16.2	25.4	55-59.....	581.5	863.5
25-29.....	27.9	38.5	60-64.....	872.4	1,327.2
30-34.....	42.5	60.5	65-69.....	1,164.2	1,851.9
35-39.....	60.4	93.0	70-74.....	1,507.3	2,420.0
40-44.....	126.4	185.4	Over 75.....	1,757.7	3,011.3

TABLE 2.—Incidence and prevalence of cancer in U. S. Navy and U. S. Marine Corps

NAVY ENLISTED

Age	1942	Percent in age group	1944	Cancer incidence rate	New cancer cases	Prev- alence rate	Prev- alence
16-19.....	111,084	18.4	469,126	10.4	49	15.3	72
20-24.....	255,907	42.38	1,080,520	16.2	175	25.4	274
25-29.....	115,108	18.4	469,126	27.9	131	39.5	173
30-34.....	58,858	10	254,960	42.5	108	60.5	154
35-39.....	28,859	5	127,480	60.4	77	93	119
40-44.....	18,387	3	76,488	126.4	97	185.4	142
45-49.....	8,468	1.4	35,694	213.9	76	321.4	115
50-54.....	4,308	1	25,496	367.8	94	528.2	135
55-59.....	2,041	0.3	7,649	581.5	44	863.5	66
60-64.....	688	0.1	2,550	872.4	22	1,327.2	34
Over 65.....	129	0.02	510	1,164.2	6	1,851.9	9
Total.....	603,837	100.00	2,549,599	-----	879	-----	1,293

MARINE ENLISTED

16-19.....	32,301	22.5	97,506	10.4	10	15.3	15
20-24.....	80,910	56.3	243,982	16.2	40	25.4	62
25-29.....	18,277	12.7	55,037	27.9	15	39.5	22
30-34.....	5,590	3.9	16,901	42.5	7	60.5	10
35-39.....	2,989	2.1	9,101	60.4	5	93	8
40-44.....	1,983	1.4	6,067	126.4	8	185.4	11
45-49.....	1,063	0.7	3,033	213.9	6	321.4	10
50-54.....	301	0.21	910	367.8	3	528.2	5
55-59.....	216	0.15	650	581.5	4	863.5	6
60-64.....	57	0.04	173	872.4	2	1,327.2	1
Over 65.....	0	0.00	0	1,164.4	0	1,851.9	0
Total.....	143,687	100.00	433,360	-----	100	-----	150

OFFICERS—NAVY AND MARINE CORPS

16-19.....	0	0	0	10.4	0	15.3	-----
20-24.....	10,679	13.1	38,747	16.2	6	25.4	10
25-29.....	23,636	29.1	86,072	27.9	24	39.5	34
30-34.....	17,997	22.2	65,663	42.5	28	60.5	40
35-39.....	13,221	16.3	48,212	60.4	49	93	45
40-44.....	7,682	9.5	28,099	126.4	36	185.4	52
45-49.....	4,406	5.4	15,972	213.9	34	321.4	51
50-54.....	1,892	2.3	6,803	367.8	25	528.2	36
55-59.....	1,006	1.2	3,549	581.5	21	863.5	31
60-64.....	491	0.7	2,071	872.5	18	1,327.2	27
Over 65.....	146	0.2	592	1,164.4	7	1,851.9	11
Total.....	81,156	100.0	295,780	-----	248	-----	337
Grand total.....	-----	-----	3,278,739	-----	1,227	-----	1,780

The most recent information available bearing on Navy and Marine Corps personnel classified in 5-year age groups is for 1942 (table 2). From the derived percentages in age groups, and assuming that these percentage figures remained nearly constant during the 2-year period of greatest naval expansion, it is possible to calculate actual numbers in quinquennial age groups for 1944 when the man-strength for that year is known. The census by age groups, thus calculated, and the known rates for incidence and prevalence of cancer among white males afford the means of determining the expected frequency of cancer in the Navy and Marine Corps. It appears that about 1,227 new cases of cancer appeared among the 3,278,739 men of the Navy and Marine Corps in 1944. The number of men suffering from cancer during the study year (prevalence) is estimated at 1,780—slightly more than $1\frac{1}{2}$ times the number of new cases. In other words, during 1944, 1 man in 2,672 developed cancer, a new-case rate of 0.37 per 1,000. During the same year, 251 patients with cancer were admitted for the first time to the United States Naval Hospital, Brooklyn, N. Y., or about one-sixth of all cases which developed in the Navy and Marine Corps.

While the number of new cases for 1944 seems impressive, it should be observed that the incidence is not significantly greater than that recorded in 1941. Data published in the Annual Report of the Surgeon General of the United States Navy (4) indicate that in that year, 121 patients with malignant tumors were admitted to the sick list. The Navy-Marine complement for the year was 344,118. Thus, in 1941, 1 man in 2,843 developed cancer, or 0.35 per 1,000 (table 3).

TABLE 3.—*Cancer in naval service, 1941 and 1944 incidence compared*

Year	Strength	New cases	New case rate
1941	344,118	121	<i>Per 1,000</i> 0.35
1944	3,278,739	1,227	.37

In 1941, admissions for benign tumors, as recorded by the Bureau of Medicine and Surgery, exceeded those for cancer and other malignant tumors in the ratio of 2 to 1. Provided this ratio remained constant, about 2,784 new cases of benign tumor would have been admitted in 1944. The expected number of tumors of all kinds totals 4,061 (table 4).

Official estimates of personnel to comprise the peacetime Navy—presumably for an indefinite period—are 500,000 enlisted men and 50,000 officers. It is predicted the Marine Corps will consist of

TABLE 4.—*Total tumors in naval service, 1941*

<i>Malignant</i>		<i>Benign</i>	
Carcinoma.....	34	Cyst.....	75
Epithelioma.....	26	Papilloma.....	34
Adenocarcinoma.....	9	Lipoma.....	34
Lymphosarcoma.....	7	Fibroadenoma.....	25
Sarcoma.....	7	Osteoma.....	18
Teratoma, testis.....	7	Fibroma.....	17
Glioma.....	7	Tumor, mixed, benign.....	14
Leukemia.....	6	Hemangioma.....	9
Hodgkin's disease.....	5	Adenoma.....	8
Hypernephroma.....	3	Nevus.....	7
Melanoma.....	2	Neuroma.....	6
Tumor, mixed, malignant.....	2	Chondroma.....	5
Lymphoma, multiple.....	1	Osteochondroma.....	5
Myxoma.....	1	Xanthoma.....	4
Tumor, pituitary.....	1	Odontoma.....	2
Neuroblastoma.....	1	Osteochondromatosis.....	1
Tumor, brain.....	1		
Tumor, mediastinum.....	1		
Total.....	121	Total.....	276

Malignant:Benign = 1:2.18.

1944

$1,277 \times 2.18 = 2,784$ benign tumors.

$1,277 + 2,784 = 4,061$ total tumors.

100,000 men and officers. The anticipated number of new cases of cancer per year for these services is 240. Prevalence (cases under treatment plus new cases) may be expected to be about 352 patients per year. It is estimated that benign tumors will number 523 per year. Thus, approximately 763 tumors of all kinds per year are predicted.

The end of combat permits major attention to turn from wounds and their sequelae to the problems of disease. Among these, cancer assumes a position of priority exceeded numerically only by diseases of the heart and cardiovascular system. In 1941, about $2\frac{1}{2}$ times as many deaths in naval service were recorded from heart disease as were listed for cancer. In the same period, cancer took $2\frac{1}{2}$ times as many lives as did tuberculosis (table 5).

TABLE 5.—*Leading causes of death, naval service, 1941*

Diseases of heart and cardiovascular system.....	85
Cancer and other malignant tumors.....	31
Tuberculosis.....	12

It is true that the chances of curing cancer vary widely among the various anatomical sites. It is also a fact that, in civil practice, the essentially incurable forms of cancer include several of the most common varieties such as stomach, esophagus, lung, prostate, and other internal cancers (5). On the other hand, malignant tumors of the skin, testes, bladder, rectum, colon, lip, tongue, other intraoral

cancers, and lymphosarcoma offer a reasonably hopeful prognosis. Ewing (6) has compared the present average 5-year cure rate for the various types of cancer with the rates considered possible under ideal conditions (table 6). The two essentials of "ideal conditions" are (1) availability of medical care and its corollary, early recognition; and (2) expertness of treatment.

TABLE 6.—*Curability of cancer*

Organ	Relative incidence	5-year cures, average	Possible cures under ideal conditions
	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
Stomach.....	22.0	1	5
Intestine.....	9.4	2	10
Rectum.....	4.3	2	15
Uterus.....	12.0	10	40
Breast.....	9.2	10	35
Liver, gallbladder.....	8.8	1	5
Prostate.....	3.9	1	10
Bladder.....	3.1	15	40
Intra-oral.....	3.0	15	50
Tongue.....	.8	10	50
Lip.....	.5	50	95
Pharynx.....	.9	1	25
Skin.....	2.5	60	85
Pancreas.....	2.5	(1)	2
Lung.....	2.2	(1)	1
Esophagus.....	1.8	(1)	1
Ovary.....	1.5	1	10
Kidney, adrenal.....	1.4	1	5
Bone sarcoma.....	1.4	2	10
Thyroid.....	11.0	1	5
Larynx.....	.8	5	50
Brain.....	.7	2	10
Testis.....	.2	5	40
Lymphosarcoma.....	¹ 3.0	1	10

¹ Exact number unknown.

It would be difficult to imagine a communal organization where medical attention would be more free of access than it is in the naval service today. Unfortunately, early diagnosis of cancer does not appear to be implicit in the mere fact of such availability. The singular adaptability of the naval service in meeting the requirements whereby the ideals of curability of cancer may be achieved is a challenge of first importance among the peacetime problems of naval medicine.

REFERENCES

1. DORN, H. F.: Illness from cancer in United States. Pub. Health Rep. 59: 33-48, January 14, 1944.
2. DORN, H. F.: Illness from cancer in United States. Pub. Health Rep. 59: 65-77, January 21, 1944.
3. DORN, H. F.: Illness from cancer in United States. Pub. Health Rep. 59: 97-115, January 28, 1944.
4. United States Navy Department, Bureau of Medicine and Surgery: Annual Report of the Surgeon General, U. S. Navy, Chief of the Bureau of Medicine and Surgery, to the Secretary of the Navy Concerning Statistics of Diseases and Injuries in the United States Navy for the Calendar Year 1941. U. S. Government Printing Office, Washington, D. C., 1944. p. 120.

5. EWING, J.: in *Treatment of Cancer and Allied Diseases*, by one hundred and forty-seven international authors; PACK, G. T. and LIVINGSTONE, E. M. (editors). Paul B. Hoeber, Inc., New York, 1940. p. 4.
6. EWING, J.: in *Treatment of Cancer and Allied Diseases*, by one hundred and forty-seven international authors; PACK, G. T. and LIVINGSTONE, E. M. (editors). Paul B. Hoeber, Inc., New York, 1940. p. 5.



ULTRAVIOLET BLOOD IRRADIATION THERAPY OF APPARENTLY INTRACTABLE BRONCHIAL ASTHMA

Summary.—The results of further study and clinical observation of the effects of ultraviolet blood irradiation therapy in 120 patients suffering from apparently intractable bronchial asthma have been tabulated. Of the 120 patients carefully followed up, 77 (64.1 percent) were found to be relatively symptom free or definitely improved, 27 (22.5 percent) were slightly improved, and 16 (13.4 percent) were unimproved.

Conclusion.—1. A marked and relatively permanent alleviation of severe dyspnea and cyanosis plus an obvious increase in general resistance has been observed in a relatively large percentage of patients suffering from apparently intractable bronchial asthma after the application of this method.

2. Blood irradiation therapy must be repeated at intervals of 2 to 8 weeks in cases of advanced asthmatic disease.

3. Six to ten months of treatment may be necessary before obvious improvement is noted.

4. Patients with advanced, severe, apparently intractable bronchial asthma cannot expect permanent alleviation of symptoms but often can be consistently relieved under constant treatment.

5. Patients with early, apparently intractable bronchial asthma respond more rapidly and maintain their improvement for longer periods than do those in an advanced stage.

6. The management of apparently intractable bronchial asthma requires, in addition to ultraviolet blood irradiation therapy, adherence to certain fundamental principles, e. g. elimination of predisposing aggravating influences, avoidance of instrumentation and nasal operations, and temporary use of epinephrine inhalants.

7. Autumnal aggravation of asthmatic symptoms occurred in approximately 30 percent of all patients under treatment but was purely temporary.

8. Children and young adults respond especially well to this type of therapy.

9. The Knott technique has been found to be a safe and efficient method of controlling apparently intractable bronchial asthma, with 77 of 120 patients (64.1 percent) who received constant treatment and observations showing and maintaining definite improvement.—MILEY, G. P., SEIDEL, R. E., and CHRISTENSEN, J. A.: Ultraviolet blood irradiation therapy of apparently intractable bronchial asthma. *Arch. Phys. Med.* 27: 24-29, January 1946.

SOME CLINICAL PROBLEMS OF AMEBIASIS

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Since the outbreak of World War II, a great deal has been said and written about the possible dissemination of tropical diseases on the North American Continent by returning servicemen. Enough experience has now been accumulated to show that certain fears regarding such dissemination are groundless. There is reason to believe that such diseases as malaria, filariasis, hookworm disease, bacillary dysentery, leprosy, yaws, tsutsugamushi disease, Japanese encephalitis (encephalitis B), leishmaniasis and schistosomiasis should be controlled in the field of military operations and that very few instances of transmission of these diseases by servicemen returning to this continent will be encountered.

Although amebiasis is not distinctly a tropical disease, it may be encountered frequently by physicians in the United States after the return of servicemen. This disease develops insidiously. It is transmitted relatively easily, both in the field of military operations and under supposedly good hygienic conditions in this country. Persons who are infected with *Endamoeba histolytica* are liable to become carriers of the parasite and symptoms of the disease may not develop until a long time after the original infection.

Amebiasis is no stranger in this country; however, many physicians are not entirely familiar with the clinical characteristics of the disease and frequently do not give it any consideration in making a diagnosis. As a result, it becomes necessary for each generation of physicians to re-educate itself as new outbreaks of the disease occur. The Chicago epidemic of 1933 is a case in point. Physicians in the Middle West perforce had to rediscover the disease in its various aspects and many had an ordinary lifetime's experience with the *Endamoeba histolytica* compressed into a few months' time. Many physicians in military service have developed a singular respect for the serious character of the disease and the difficulties which may attend its diagnosis.

INCIDENCE AND EPIDEMIOLOGY

Because amebiasis is transmitted by man rather than by insects, it occurs in practically all parts of the world. It occurs in endemic form in Central America, the West Indies, the Malay Archipelago, the Philippine Islands, northern and southern China, India, and Burma. In these places, physicians habitually consider the possibility of this disease in every case of disease of the abdomen. The disease is by no means rare in the southern and central parts of Europe. It is being encountered with increasing frequency in the northern part of Europe. Conditions incidental to global war undoubtedly favor the spread of the disease, even in regions in which it previously was not prevalent.

In 1919, Kofoed, Kornhauser and Plate (11) found *Endamoeba histolytica* in the stools of 10.8 percent of 1,200 soldiers who had returned from France. Service in a region in which amebiasis is endemic obviously increases the incidence of infection with *Endamoeba histolytica*. Sapero and Johnson (14) found that the incidence of infection with this parasite was 26 percent among Navy personnel who had returned from duty in Peking, Shanghai, and the Philippine Islands as contrasted with an incidence of 7 to 14 percent among naval recruits. These rates may seem high but different surveys have disclosed that the incidence of infection with this parasite in civilians in the United States ranges from 2 to 10 percent. In 1923, Boeck and Stiles (2) reported the results of a study of the stools of 8,029 persons who were patients in hospitals or inmates of institutions. The incidence of amebic infection among them was 4.1 percent. It should be stated, however, that 1,547 of the 8,029 persons had not been in the military service. Markell (13), who made a study of 1,371 servicemen who were patients in a naval mobile hospital in New Zealand, found that the incidence of amebic infection was 8.1 percent. Wood and Dyke (18) found that the incidence of this infection was 2.1 percent among 805 service men who were patients in a naval hospital on the west coast. This figure seems relatively low but many patients had been examined and treated before they were returned to the United States. As Brown (3) has pointed out, the incidence of amebic infection, as determined by various investigators, depends on three factors: (1) The enthusiasm and skill of the investigator, (2) the geographic latitude, and (3) the sanitary level of the district in which the investigation is conducted.

In practically all epidemics of amebiasis the *Endamoeba histolytica* is disseminated by contaminated water. When the protozoan is in the trophozoic stage it is killed rather rapidly by exposure to air but when it is in the cystic stage it is more resistant and will live

for a long time in water, even at rather low temperatures. It is of particular interest that chlorination of water, which furnishes adequate protection against infection with the typhoid-colon group of microorganisms, has no effect on the cysts. The cysts may be killed by boiling the contaminated water or they may be removed by filtering the water through sand.

Contaminated water has been responsible for two of the most extensive epidemics of amebiasis that have been observed in recent years, namely, the one which occurred in Chicago at the time of the World's Fair in 1933 and the one that occurred after the fire in the Union Stockyards in the same city in 1934. In the first of these epidemics more than 1,000 cases of amebiasis are known to have occurred and at least 52 of the affected persons died. In the latter epidemic, amebiasis developed in about 100 firemen who had drunk water polluted with human excreta.

In the majority of cases in which cystic forms of *Endamoeba histolytica* are found in the stools, the infected persons never have had any frank signs or symptoms of amebic dysentery. In many cases in which carriers of this parasite have died of other diseases or as the result of an accident, necropsy has failed to disclose any evidence of involvement of the intestine. In other cases, for example, those reported by Faust (8), the only intestinal lesions disclosed by necropsy were superficial and confined to the mucosa. Why active lesions of the intestine do not develop more frequently than they do in contact carriers is not known. Such lesions presumably might develop after an acute infection or after an abdominal operation. This seemed to occur in some cases which I observed at the time of the epidemic in Chicago. No one knows as yet what "sets off" amebic dysentery and why immunity may be lost after it develops.

A convalescent carrier is a person who has recovered from the symptoms of the disease but still harbors the parasite. As he previously was susceptible it may be expected that symptoms will develop again. Convalescent carriers frequently are encountered in the naval service and many servicemen have had intermittent attacks of the disease over a period of years. Although the symptoms may have been mild at the time of the original attack, there is no guarantee that subsequent attacks will pursue such a favorable course.

In the case of convalescent carriers, proctoscopy should be performed and the colon should be examined roentgenologically to determine whether subclinical lesions are present. Both contact carriers and convalescent carriers should receive vigorous treatment, and follow-up studies should be made to insure that the amebic infection has been eradicated.

PATHOLOGY

In the case of human beings, the infection probably always is caused by ingestion of the cystic form of the parasite. The parasites develop in the intestine and each cyst gives rise to four small trophozoites. These attach themselves to the mucosa of the large intestine and subsequently penetrate both the mucosa and submucosa. Their active movements and a cytolytic substance which they elaborate facilitate the process. Small patches of necrosis develop at the sites of penetration. These necrotic patches rupture and form small ulcers. If the resistance to the parasite is high, the process may go on to partial healing and the lesions may remain microscopic in size. If the defensive forces are inadequate, the destructive process extends in the submucosa and undermines the mucosa, and large flask-shaped ulcers form. These may become secondarily infected from contact with intestinal contents. In cases of severe or long-standing infection, granulomas may form or the intestinal wall may be perforated and extraluminal abscesses may form. Later, the intestine may be irregularly constricted by scars and extensive adhesions may deform it by extrinsic pressure.

The parasite often invades the venous plexuses of the submucosa and reaches the portal vein. Once the parasite reaches the portal venous stream in quantity, the ground work for hepatic abscess has been laid. The first stage is probably an amebic hepatitis, the existence of which was postulated by Rogers years ago and which, incidentally, is a process as yet not fully understood. The initial lesion is probably one of miliary focal necrosis with the usual reaction of the liver tissue to an insult of this type. Abscesses form when small patches of necrosis extend and coalesce. The smallest abscesses contain thick glairy mucoid material; the larger ones have liquid or purulent contents. As multiple small abscesses develop, coalescence is the rule. Usually, only one large abscess is found situated in the right lobe of the liver.

The distribution of amebic ulcers in the intestine is of great clinical importance. The initial lesion most often occurs in the cecum. At a later date, the lesions are widely distributed in the large intestine. The appendix is occasionally involved, and may perforate. The lower part of the ileum rarely is affected. In Clark's (5) series of 186 fatal cases, the distribution of ulcers in the colon was as follows: Cecum 87.3 percent; ascending colon, 57.1 percent; rectum, 39.6 percent; and appendix, 33.3 percent. The preponderance of lesions in the right half of the colon explains why many individuals with amebiasis have little or no diarrhea and also (because of the streamlining of the

portal flow from this part of the intestine) why the right lobe of the liver is most often the site of an amebic abscess.

It is obvious that, once the parasite invades the blood stream by way of the portal vein, or penetrates the intestinal wall, amebic abscesses may form in other parts of the body. The liver is such an efficient filter that most of the organisms lodge there but primary abscesses have been found in the lung, pleura, brain, kidney, ovary, and bone.

After an abscess of the liver has formed, it may remain relatively stationary or it may extend by various routes. One common route of extension is through the diaphragm into the pleural cavity and lung and thence into a bronchus. Occasionally, the abscess in the liver and the lung may form one large cavity and the identity of the intervening portion of the diaphragm may be lost. Curiously, abscesses of the liver rarely extend into the larger bile ducts. Berkman and Bargen (1) reported a unique case in which two fistulas developed, one between the abscess of the liver and the skin and the other between the abscess and the common bile duct.

SIGNS AND SYMPTOMS

The signs and symptoms are by no means as constant and as distinctive as textbooks would indicate; in fact, they often are so bizarre as to confuse even the most experienced observer. The usual classification of amebiasis into acute amebic dysentery, chronic amebic dysentery, amebic colitis with dysentery, and asymptomatic amebiasis is one that is more easily made on paper than in actual practice.

It is generally believed that contact carriers do not have symptoms of amebiasis at any time but Craig (6) expressed the opinion that at least 50 percent of carriers will have some symptoms. Dull pain in the abdomen, tenderness on pressure along the course of the colon, and a mild degree of anemia may be present. Such signs and symptoms are present in a host of organic and functional disturbances of the abdomen. I can testify that such signs and symptoms sometimes occur in carriers and disappear after antiamebic treatment.

In cases of active amebiasis, the presenting symptoms may vary greatly. There may be such symptoms as those mentioned in the preceding paragraph. On the other hand, the disease may be acute and be associated with bloody diarrhea, intense pain in the abdomen, chills, vomiting, and collapse. Such symptoms usually are associated with diphtheroid or gangrenous lesions of the intestine. Free intestinal bleeding may occur. Such symptoms probably occur in cases of massive infestation in which the amebic ulcers are infected secondarily. Cases of this type were observed in the Chicago epidemic in 1933. In

such cases, the period of incubation appears to be very short and the disease may prove fatal.

In a majority of cases, the disease begins insidiously after an incubation period of weeks or months. Moderate diarrhea, occurring at irregular intervals and sometimes accompanied by tenesmus with bloody mucus in the stools, is the rule. There may be loss of weight, anemia, and soreness over the lower part of the abdomen. The pain and tenderness may be sufficiently well localized in the right lower quadrant to suggest the presence of appendicitis. In the Chicago epidemic, a diagnosis of appendicitis was made in 41 cases and operation was performed in 32 of them (16). Death occurred in 13 of the 32 cases. Snapper (15) reported a case in which perforation of the cecum was followed by peritonitis and a retrocecal abscess which involved the psoas muscle.

In most cases of mild intestinal forms of the disease, the clinical symptoms are not of a localizing character. They may abate spontaneously, to recur at intervals of months or years. As the stage of chronicity is reached, there are increasing irritability of the bowel, further loss of weight, anemia, and slight fever. This type of the disease may simulate a malignant disease. I know of two cases in which a diagnosis of carcinoma of the colon was made on the basis of such symptoms plus the roentgenologic demonstration of a deforming lesion in the cecum or colon.

In addition to these symptoms there are a host of much less definite clinical pictures observed in cases of intestinal amebiasis, the most common of which is associated with poorly localized and vague abdominal symptoms and a gradual decline in general health. It is on such a clinical picture, which is too vague to excite suspicion of the presence of amebiasis that the signs and symptoms of complications are most often superimposed.

Physical signs of the purely intestinal forms of amebiasis are conspicuous by their absence. Rarely, an indefinite mass may be present in the right lower quadrant and even less commonly a granulomatous mass or an ulcer may be palpated by rectum. Laboratory data other than those obtained by examination of the stools are not, as a rule, revealing. Slight leukocytosis and moderate degrees of secondary anemia are the only findings of consequence. Proctoscopic examination, which incidentally should be performed much oftener than it is in cases in which the presence of amebiasis is suspected, may disclose valuable information. Jackman and Cooper (10) made a study of 115 cases of amebiasis in order to determine the diagnostic value of proctoscopy. In 24 cases (21 percent), proctoscopy disclosed ulceration of the lower part of the bowel. In two cases in which repeated examination of the stools had failed to disclose *Endamoeba histolytica*, the organism

was disclosed by examination of a smear or a specimen obtained by proctoscopy. Anal abscesses and fistulas, which commonly are observed in ulcerative colitis and regional ileitis, were conspicuous by their absence in this series of cases. Amebic involvement of the perianal skin is very rare. Pseudopolyps were observed in two cases. One patient had a rectal stricture and one patient had an amebic granuloma which simulated a rectal carcinoma. Other observers (Donald and Brown (7)) who have observed patients with more active types of the disease have found that proctoscopy discloses characteristic lesions in a higher percentage of cases.

Roentgenologic studies of the colon show somewhat less in the way of a characteristic picture that might be expected. In certain cases, the roentgenologic appearance of the colon resembles that seen in cases of chronic thrombo-ulcerative colitis. The finding most typical of amebiasis is a "coning" of the cecum, owing to distortion of this portion of the colon by amebic ulceration.

COMPLICATIONS AND SEQUELAE

As has been previously mentioned, the most common complication is liver abscess. Its probable precursor, amebic hepatitis, is most often diagnosed by finding an enlarged and tender liver in a case of known amebiasis. The condition may be attended by slight fever, leukocytosis and minor degrees of jaundice; the whole picture tends to clear up rapidly on emetine therapy. How often a diffuse hepatitis precedes the development of an abscess is not known; certainly, the abscess often seems to occur when least suspected and without prodromal symptoms which are characteristic.

In describing the symptoms of liver abscess one cannot do better than to quote Frerichs (9), who said: "Local symptoms, however, are often so ill-defined, or so obscured by others, that it is a difficult matter to analyse (them) correctly, to distinguish between the essential and nonessential symptoms, and to separate the primary and consecutive derangements from those directly referable to the fundamental lesion."

Pain is the most constant single symptom of abscess of the liver. It is most often of a dull constant character and may be localized in the right upper quadrant of the abdomen or in the lower part of the right side of the thorax. It may be elicited or intensified by pressure over the liver. Extension to the region supplied by the phrenic nerve is not as frequent as is generally believed.

In many cases, a proved amebic abscess of the liver has been virtually asymptomatic and the abscess has not been discovered until perforation occurred. This was true in the cases recently reported by Walters, Watkins, Butt, and Marshall (17). In some cases, the only symptoms are fever of a septic type and loss of weight. In other cases, enlarge-

ment of the liver is associated with a sense of weight or fullness in the right upper quadrant of the abdomen. I have observed one case in which the abscess was of long duration and at first was believed to be a metastatic carcinoma. In many cases of liver abscess the past history is of little help in diagnosis; diarrhea may have been too mild to attract attention and there is often no history of residence in an area in which amebiasis is endemic.

The principal physical sign of hepatic abscess, namely, enlargement of the liver, may be demonstrated in various ways. In cases in which the abscess is chronic or occurs late in the course of the disease, enlargement of the liver sometimes may be detected by simple inspection; the lower part of the thorax is flared and asymmetrical and the intercostal spaces may bulge. Often, the liver does not extend greatly below the costal margin and the enlargement is chiefly in an upward direction. Although such extension occasionally may be detected by physical signs, roentgenograms of the thorax or roentgenoscopy usually is required to show elevation, "tenting," and fixation of the diaphragm. Exceptionally, an abscess may present in the epigastrium or in the right upper quadrant. I know of one case in which an abscess was incised on the presumption that it was a pancreatic cyst. The resulting sinus was not identified as being due to amebiasis until months later, when the parasite was demonstrated in scrapings from the eroded margins of the skin.

Laboratory data are of limited aid in the diagnosis of a liver abscess. A significant leukocytosis is usually present, but very often the one thing that is essential for diagnosis, namely, the demonstration of *Endamoeba histolytica* in the stools, is lacking. Why this should be so is not known, but many observers have commented on their inability to find the parasite even after prolonged and careful search. Studies of hepatic function do not give the assistance which might be expected of them. In about half of the cases, the bromsulphalein test shows that the function of the liver is decreased (Brown). Other methods, such as the cephalin-chloesterol flocculation test, have not received an extensive clinical trial. Often, the only means of positively identifying an amebic abscess of the liver is by diagnostic aspiration or surgical exploration, with a subsequent search for the parasite in the drainage.

Certain generalizations in regard to the diagnosis of liver abscess may be offered. This lesion should be kept constantly in mind as a diagnostic possibility in any case of abdominal pain and fever in which the patient formerly lived in a tropical country. It is most often demonstrated by a study of the roentgenoscopic appearance of the right half of the diaphragm, with special reference to elevation,

"tenting," and fixation. For every case in which the diagnosis is made by finding the *Endamoeba histolytica* in the stools, there is one in which the diagnosis is made by observing the therapeutic effect of emetine.

Other complications of amebiasis, such as abscesses of the lung or brain, are rare and little need be said regarding them except to note that they exist. One sequela of the disease, namely, amebic appendicitis and typhlitis, is sufficiently common to warrant a word of caution. The high mortality of appendectomy in cases of amebiasis is well known. If the appearance of the appendix or cecum, at operation, suggests the possibility of amebiasis, administration of emetine should be instituted immediately, pending the receipt of the pathologic report on the appendix. The affected appendix is usually described as "much enlarged" and the presence of a severe periappendicitis is noted; the cecum may or may not be grossly involved, with edema and induration of the wall. Search for the parasite in sections of the appendix under such circumstances may be rewarded with the finding of the parasite.

At operation the finding of an enlarged purplish liver that is adherent to the diaphragm and abdominal wall should suggest an inflammatory type of hepatitis of amebic origin and should likewise lead to a trial of antiamebic treatment. Such a precaution may save lives and is almost certain to do no harm.

DEMONSTRATION OF *ENDAMOEBA HISTOLYTICA*

A positive diagnosis depends on the demonstration of the *Endamoeba histolytica* in the stools or tissues or in material obtained from rectal ulcers, sinuses, or abscess cavities. It cannot be emphasized too strongly that a single examination, especially of a cold formed stool, does not exclude amebiasis. Examination of three warm stools, obtained after saline catharsis on consecutive mornings, will reveal the organism in perhaps 90 to 95 percent of cases of amebiasis. Manson-Bahr (12) insisted that daily examinations of warm liquid stools should be continued for at least 7 consecutive days before concluding that an individual does not have amebiasis. I know of cases in which a positive diagnosis was not made until 12 to 15 stools had been examined. Such a prolonged search is tedious and time-consuming for both the patient and physician but the trouble taken is often well repaid.

Some confusion may arise in distinguishing *Endamoeba histolytica* from nonpathogenic amebae such as *Endamoeba coli*, *Endamoeba nana* and *Iodamoeba buetschlii*, and the services of an experienced parasitologist are often necessary, especially to identify the encysted forms. Special staining methods are helpful. The motility of the pathogenic

trophozoites and their tendency to engulf erythrocytes are valuable distinguishing points.

Various authors have ascribed special value to the examination of material obtained directly from rectal lesions. Pus obtained from abdominal sinuses that have been present for some time ordinarily does not contain the parasite but, if the infected edges of the skin at the periphery of the sinus are scraped lightly and the material thus obtained examined, the organism may be easily demonstrated. If a liver abscess discharges through a bronchus, as happens not infrequently, the sputum may contain trophozoites. Histologic examination of such tissue as the appendix or the margins of a sinus may reveal the parasite. Demonstration of the parasite under such conditions requires the examination of several blocks of tissue and the use of special stains, such as Best's carmine stain. Cultural methods and complement fixation tests have received much attention, but are still not in general use.

TREATMENT

Since the introduction of emetine by Rogers in 1912, the medical profession has had at its disposal a drug which controls the active symptoms of the amebiasis. There is no disease condition which responds to specific treatment in a more dramatic manner; often only 1 or 2 grains (0.065 to 0.13 gram) of emetine will produce remarkable clinical improvement in from 24 to 48 hours. The effectiveness of the treatment is, paradoxically, its greatest weakness; emetine is not curative and always should be supplemented, no matter how good the immediate result, by other remedies designed to kill the parasites still present in the intestinal wall. Of these remedies, the best now available are carbarsone and such oxyquinoline compounds as chiniofon, vioform (5-chloro-7-iodo-8-hydroxyquinoline) and diodoquin (5-7-diiodo-8-hydroxyquinoline).

Many plans of treatment have been used. Brown recommended the following plan: A dose of 1 grain (0.065 gram) of emetine hydrochloride is administered subcutaneously twice daily for 3 days; after 1 week has been permitted to elapse, the treatment is repeated for 2 days; at the end of this period, 0.25 gram of carbarsone is administered, in a capsule, twice daily for 10 days; after a period of 10 days has elapsed, carbarsone is administered as it was on the previous occasion; and after another interval of 10 days, a third course of carbarsone is given. In cases in which this treatment does not produce relief and in cases in which an unknown amount of emetine or carbarsone recently has been administered, Brown recommended three courses of therapy with chiniofon, diodoquin, or vioform. An interval of 1 week is permitted to elapse between each course. Manson-Bahr

advised the use of chiniofon and emetine bismuth iodide simultaneously.

The treatment usually employed at naval hospitals is as follows: A dose of 1 grain (0.065 gram) of emetine hydrochloride is administered subcutaneously, once daily, for 5 days. Administration of carbarsone is started on the third day. A capsule containing 0.25 gram of carbarsone is administered three times a day for 7 days. After an interval of 7 days, vioform is administered orally. A dose of 0.25 gram of vioform is administered three times daily for 7 days. After another interval of 7 days, the course of carbarsone is repeated.

In the treatment of an amebic abscess, longer (8 to 10 days) courses of emetine in doses of 1 grain daily are advised at intervals of 3 weeks or longer. The doses of carbarsone and vioform should be regulated according to the degree of intestinal involvement.

Emetine, as is well known, must be used with considerable caution because it is liable to produce toxic effects. The margin between the effective dose and the toxic dose is small, but in spite of this the drug has been employed successfully for years and relatively few serious toxic reactions have been reported. It is inclined to produce a cumulative effect. Toxic symptoms include a decrease in the blood pressure, nausea, vomiting, cardiac irregularity and changes in the electrocardiographic pattern. In some cases, peripheral neuritis may develop; possibly, nutritional disturbances incidental to the disease may play an etiologic role.

The arsenical drugs (carbarsone and treparsol) contain approximately 60 percent of arsenic by weight and occasionally produce symptoms of acute arsenical poisoning, notably, arsenical dermatitis, in susceptible individuals. Although the quinoline drugs are hepatotoxic agents, acute necrosis of the liver rarely has been reported after their use. Chiniofon may cause troublesome diarrhea. All of these toxic effects are fortunately rare; the possibility of inducing further hepatic damage, even in cases of amebic hepatitis, seems remote.

Treatment under proper control should always be undertaken even in cases in which the patients are severely debilitated. The tolerance of such patients usually is surprisingly good. In a case reported by Berkman and Bargaen, the patient took the astounding total of more than 10 grams of emetine hydrochloride at various times over a period of 14 years, along with comparable amounts of other anti-amebic drugs. No ill effects resulted.

A word may be added in regard to therapeutic tests, which under some circumstances are extremely useful. Active dysentery that is due to *Endamoeba histolytica* will, as a rule, be controlled by as little as 0.13 to 0.20 gram of emetine; fever, if present, will subside and

abdominal pain and toxemia will diminish or disappear. With more protracted treatment, the liver, if enlarged, will diminish in size and the diaphragm will return to its normal level. Draining sinuses heal rapidly and there is usually an immediately favorable effect on the general condition of the patient. If other conditions have been reasonably well excluded and the patient shows the usual prompt and dramatic response to emetine therapy, the diagnosis of amebiasis is thereby established even if the parasites have not been demonstrated. A negative therapeutic test does not, however, invariably exclude the presence of amebiasis; in cases in which a hepatic abscess extends to the lungs, the patients may sometimes react very poorly if at all.

RESULTS

Immediate control of the symptoms of amebiasis and relief from the added handicap of complications are usually easy to obtain; complete cure is a different matter. Prolonged and carefully supervised treatment is required. The stools should be examined repeatedly and multiple courses of treatment should be employed as indicated. With the use of the treatment that has been outlined, perhaps 90 percent of affected persons will have no further trouble. Relapses after long intervals are, unfortunately, not rare, even in cases in which there apparently are no gross lesions of the bowel or liver.

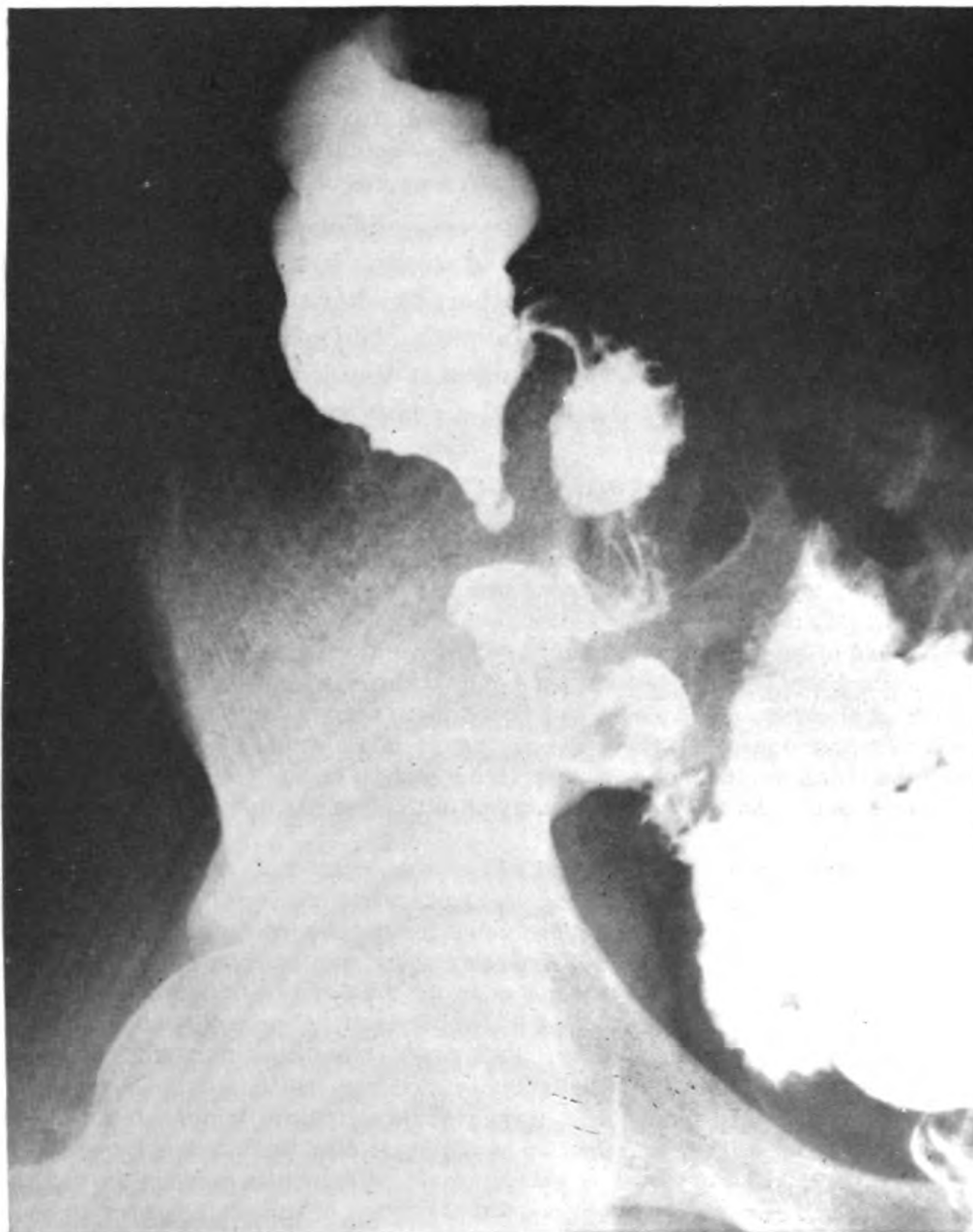
Liver abscess always deserves a prolonged trial of medical treatment, with or without aspiration of the abscess, before open drainage is considered. It is surprising how large an abscess will undergo complete resolution. In 14 of 17 cases of amebic abscess of the liver reported by Brown and Hodgson (4), medical treatment proved satisfactory. Surgical drainage, however, is usually required in cases in which there is involvement of the lung and pleura and in cases in which the abscesses are very large, chronic or secondarily infected. Open or closed drainage is obviously indicated in cases in which the patients do not respond satisfactorily to a course of antiamebic therapy. Patients usually respond satisfactorily if the diagnosis is made early and if adequate treatment is employed.

CASE REPORTS

The case reports which follow are intended to illustrate some of the less common features of the disease and to point out certain difficulties of diagnosis. These difficulties are especially pronounced in three groups of cases: (1) Those in which the disease has been present for a long time and is associated with cachexia that simulates that caused by a neoplasm, (2) those in which the amebiasis is associated with another disease, and (3) those in which there is no history of involvement of the intestine.

The first case which I shall report illustrates the remarkable chronicity and latency of the disease, and the tendency for relapses to occur and for residual lesions to occur occasionally in the intestine, lungs, and liver.

Case 1.—A naval lieutenant, 33 years of age, had served in China for several years, but never had an attack of diarrhea that had lasted longer than a few days. When he had returned to the United States he had noticed loss of weight and progressive weakness. He had been sent to a naval hospital for observation. A lesion in the right pleural cavity had been found but the exact nature of the



1. (Case 1.) "Coning" of the cecum. A characteristic roentgen appearance of the cecum in amebiasis.

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lesion had not been determined. Aspiration of a fluid-containing lesion at the base of the right lung had disclosed *Endamoeba histolytica*. It seems probable that the lesion was an abscess of the liver. The cavity had been flushed with a solution of emetine and standard antiamebic treatment, including emetine and carbarsone, had been employed. He had been free of symptoms for the next 3 years and had felt perfectly well. He had had two attacks of diarrhea in 1940 but antiamebic treatment had produced relief. While he had been in the South Pacific area in 1941, he had had another attack of diarrhea, which also had been treated with emetine and carbarsone. In 1943, he was admitted to another naval hospital because he had pain in the lower part of the abdomen and was passing four or five loose stools daily. Physical examination revealed only slight wasting and pallor. Roentgenologic examination with a barium enema revealed a lesion of the cecum which was considered typical of amebiasis (fig. 1). He was given a routine course of antiamebic therapy and, for the fourth time, improved greatly. Roentgenologic examination revealed that the right lung was clear except for adhesions at the base. Similar examination of the hepatic region disclosed a large area of calcification, which was presumed to be a healed abscess.

The next case illustrates the diagnostic difficulties caused by multiple tropical diseases. The degree of anemia in this case and the response of the anemia to antiamebic therapy after the other diseases had been adequately controlled are unique. Mild anemia is common in cases of amebiasis but severe anemia is rare unless there has been free bleeding from ulcers in the bowel, a complication not known to be present in this case.

Case 2.—A Marine corporal, 22 years of age, was sent to a naval hospital in this country because of postmalarial asthenia. He was admitted to the hospital on 20 October 1944. He had had benign tertian malaria in the Solomon Islands in May 1944, and he had had a second attack 3 weeks later. At the time of the initial attack, the chief symptom had been weakness. Since the second attack, he had had about six chills and had been treated as an ambulatory patient. He had not had any gastro-intestinal symptoms with the exception of an occasional attack of diarrhea, which never had lasted more than a day. His appetite had been reasonably good and there was no history of intestinal bleeding. The trip from the South Pacific had been very trying and he had received a blood transfusion en route. At the time of his arrival in this country, he was very pale and weak.

Physical examination did not disclose any significant abnormality. The erythrocyte count was 1,300,000 and the leukocyte count was 11,600 per cubic millimeter of blood respectively. The value for the hemoglobin was 5 gram per 100 cc. of blood. The differential leukocyte count was essentially normal.

The patient received a blood transfusion on the day of his admission to the hospital. Later in the day, he had a definite chill. Examination of a blood smear disclosed *Plasmodium vivax*. Full doses of atabrine were administered for several days. In spite of a satisfactory diet, repeated transfusions of blood and clinical control of the malaria, there was no significant improvement in his blood count. Subsequent examination of the blood disclosed macrocytic anemia. Parenteral administration of liver extract produced little improvement (although the reticulocytes eventually comprised 5 to 8 percent of the erythrocytes as contrasted to a 1-percent level before treatment was begun). Analysis of the gastric contents disclosed an absence of free hydrochloric acid. Examination of the

stools revealed the presence of hookworm ova. Eradication of these ova did not alter the anemia significantly.

Another attack of malaria occurred. After this attack, irregular fever occurred each afternoon. Meantime the erythrocyte count remained approximately 2,500,000 per cubic millimeter of blood. Subsequent examination of the stools disclosed the presence of trophozoites and cysts of *Endamoeba histolytica*.

Emetine hydrochloride was administered. The condition of the patient improved rapidly. Roentgenologic examination of the gastro-intestinal tract disclosed clumping and a bizarre distribution of the barium which were consistent with the roentgenologic findings in cases of deficiency disease.

The patient's improvement continued throughout the month of December and, although his reticulocyte count was no higher than it had been previously the erythrocyte count rapidly returned to normal. He was transferred to another naval hospital nearer his home in the latter part of December. When he reached this hospital, his blood count was reported as follows: The erythrocyte count was 4,100,000, the leukocyte count was 13,500, and the value for the hemoglobin was 81 percent.

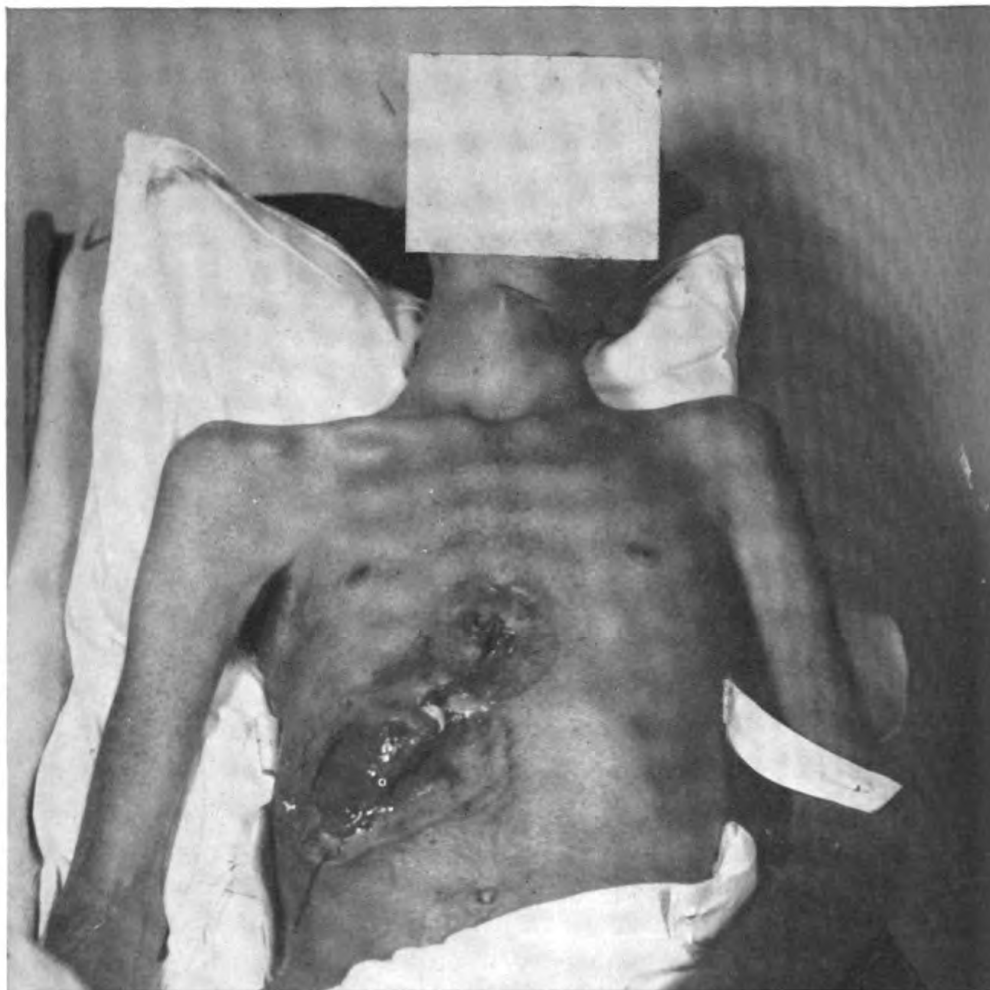
Although it cannot be definitely stated that the amebiasis in this case was solely responsible for the constant and persistent anemia, it is clear that there was no improvement until antiamebic treatment was begun. The eradication of the hookworm infestation, treatment of malaria, blood transfusions and administration of liver extract had failed to produce the desired effects on the patient's blood count.

Case 3 is another example of the presence of multiple diseases. In this case, the most serious of the three diseases was the last to be discovered. Persistence in examining stools and blood smears made the diagnosis possible and resulted in prompt recognition of a developing liver abscess, which undoubtedly avoided the necessity of surgical drainage.

Case 3.—A Marine captain, 33 years of age, was admitted to an overseas naval hospital because of chills, fever, headache, and moderate tenderness in the epigastrium. Examination of blood smears failed to disclose plasmodia of malaria. He was transferred to another overseas activity where urologic examination disclosed the presence of pyelonephritis. He was then transferred to the United States. On arrival, he was ambulatory and complained only of pain in the left lumbar region and fever. Physical examination revealed a low-grade afternoon fever and tenderness on first percussion in the left renal area. Cystoscopy revealed pus in the left renal pelvis and the roentgenologic findings were suggestive of caliectasis on the left side.

On 20 November 1943 an exploratory operation revealed incomplete rotation of the kidney and pyelonephritis, caused by obstruction at the ureteropelvic junction by an aberrant vessel. The condition was surgically corrected. The urine became clear but fever continued and the patient had severe chills. Examination of a series of blood smears finally demonstrated plasmodia of malaria and the fever responded temporarily to antimalarial therapy.

After a successful treatment of the malaria, a septic type of fever developed. This was associated with pain and tenderness over the liver. After repeated examination of the stools for a long period, cysts of *Endamoeba histolytica* were found. Roentgenologic examination of the thorax revealed findings



2. (Case 4.) Draining amebic abscess of liver with amebic involvement of skin edges.

that were suggestive of a subdiaphragmatic abscess with an associated sero-fibrinous pleurisy on the right side. Emetine therapy produced remarkable improvement. Repeated roentgenologic examination revealed progressive subsidence of the hepatic and pulmonary lesions. After he had had several courses of emetine therapy, examination of the stools no longer disclosed *Endamoeba histolytica*.

Case 4 is of interest because of the insidious development of a liver abscess and the rare manifestation of amebiasis of the skin adjacent to a draining sinus.

Case 4.—A ship's cook had been admitted to an Army station hospital in Guam on 29 October 1944 because of acute pain in the abdomen, nausea and vomiting. An appendectomy had been performed. The surgical findings were not available, but the preoperative history, as related later by the patient, was not typically that of acute appendicitis. The operation had not relieved the epigastric pain. One week later, a fluctuating mass had developed in the epigastrium. This had been drained surgically and the patient had been treated thereafter with penicillin, sulfadiazine, and transfusions of blood.

When he was admitted to a naval hospital in the United States on 23 De-

cember he had a huge draining subcostal wound and another abscess was forming near the xiphoid cartilage. This was drained at a later date and much foul necrotic material was recovered. Drainage from both wounds was profuse and the patient continued to have fever and to fail in spite of vigorous supportive treatment. A pleural effusion occurred on the right side but its contents were sterile on culture. Injection of iodized oil into the draining abdominal sinuses disclosed a possible connection with an underlying liver abscess, and, because of this, scrapings were taken from the edges of the wound. The edges of the skin, incidentally, were rapidly being eroded and the general appearance of the margins of the wound suggested a phagedenic ulcer. Examination of the smears disclosed innumerable motile forms of *Endamoeba histolytica*.

Antiamoebic treatment produced steady improvement and the huge abdominal wound is gradually closing (fig. 2). The edges of the skin are clean and normal granulation is taking place. Some involvement of the base of the right lung persists and there is evidence that the suppurative process has reached a bronchus of the lower lobe of the right lung. No amebae have been demonstrated in the sputum.

SUMMARY AND CONCLUSIONS

There is good reason to believe that the incidence of amebiasis in the United States will increase with the return of service personnel from tropical and subtropical areas where the disease is endemic. Physicians are reminded that the disease occurs in many bizarre and atypical forms. Diagnosis depends almost entirely on a high degree of suspicion, a diligent search for parasites in the stools, and the judicious employment of emetine as a therapeutic test. The disease presents a public health problem of considerable importance because of the ease with which carriers may contaminate water supplies and produce outbreaks of epidemic proportions.

REFERENCES

1. BERKMAN, J. M. and BARGEN, J. A.: Amebic abscess of liver with choledochal and external fistulas; report of case. *Proc. Staff Meet., Mayo Clin.* 17: 481-487, September 9, 1942.
2. BOECK, W. C. and STILES, C. W.: Studies on various intestinal parasites (especially amoebae) of man. U. S. Pub. Health Serv. Hyg. Lab. Bull. No. 133. U. S. Government Printing Office, Washington, D. C., 1923.
3. BROWN, P. W.: Amebiasis. *North Carolina M. J.* 5: 1-4, January 1944.
4. BROWN, P. W. and HODGSON, C. H.: Late results in treatment of amebic abscess and hepatitis of liver. *Am. J. M. Sc.* 196: 305-313, September 1938.
5. CLARK, H. C.: Distribution and complications of amebic lesions found in 186 postmortem examinations. *Am. J. Trop. Med.* 5: 157-171, March 1925.
6. CRAIG, W. M.: Quoted by STRONG, R. P.: *Stitt's Diagnosis, Prevention and Treatment of Tropical Diseases*, 7th edition. The Blakiston Co., Philadelphia, 1944. Vol. 1, p. 486.
7. DONALD, C. J., JR., and BROWN, P. W.: Amebic granuloma simulating carcinoma of rectum. *Proc. Staff Meet., Mayo Clin.* 15: 321-323, May 22, 1940.
8. FAUST, E. C.: Amebiasis in New Orleans population as revealed by autopsy examination of accident cases. *Am. J. Trop. Med.*, 21: 35-48, January 1941.
9. FRERICHS, F. T.: A clinical treatise on diseases of the liver. (Translated by Charles Murchison.) William Wood & Co., New York, 1879.

10. JACKMAN, R. J. and COOPER, W. L.: Value of proctoscopy in diagnosis of amebiasis. *Am. J. Digest. Dis.* 10: 365-366, October 1943.
11. KOFOID, C. A., KORNHAUSER, S. I., and PLATE, J. T.: Intestinal parasites in overseas and home service troops of U. S. Army. *J. A. M. A.* 72: 1721-1724, June 14, 1919.
12. MANSON-BAHR, P. H.: *Manson's Tropical Diseases*. 11th edition. Williams & Wilkins Company, Baltimore, 1940.
13. MARKELL, E. K.: Intestinal parasitic infections in Naval hospital in New Zealand. *U. S. Nav. M. Bull.* 44: 65-68, January 1945.
14. SAPERO, J. J. and JOHNSON, C. M.: *Endameba histolytica* and other intestinal parasites; incidence in variously exposed groups of the Navy. *U. S. Nav. M. Bull.* 37: 279-287, April 1939.
15. SNAPPER, I.: *Chinese Lessons to Western Medicine*. Interscience Publishers, Inc., New York, 1941.
16. STRONG, R. P.: *Stitt's Diagnosis, Prevention and Treatment of Tropical Diseases*. 7th edition. The Blakiston Co., Philadelphia, 1944. Vol. 1, p. 538.
17. WALTERS, W., WATKINS, C. H., BUTT, H. R., and MARSHALL, J. M.: Amebic abscess of liver unsuspected until perforation. *J. A. M. A.* 125: 963-966, August 5, 1944.
18. WOOD, D. and DYKE, L.: Personal communication to the author.



ORAL PENICILLIN

Author's conclusion.—1. Penicillin given by mouth was absorbed from the gastro-intestinal tract. Higher and more prolonged blood levels were reached by ingested penicillin in combination with buffers, such as trisodium citrate and aluminum hydrate gel. These differences appeared to be especially pronounced when medication preceded or followed food intake by a short interval. Buffered penicillin is superior to penicillin in oil-beeswax mixture. The ration of comparable doses in oral (penicillin buffered with sodium citrate) and parenteral (plain penicillin) administration was found to be about 3 to 1.

2. Given in doses which were approximately three times higher than the customary parenteral doses, penicillin by mouth proved to be therapeutically effective in pneumonia, in upper respiratory infections and their complications, in gonorrhea, and in pyogenic cutaneous infections.

It appears inadvisable to supplant parenteral with oral penicillin indiscriminately. Parenteral administration still remains the method of choice, at least during the early acute phase, in the very sick patients with septicemia or meningitis. Further studies are indicated for the role of oral penicillin in the prevention of recurrences in rheumatic infection, in the treatment of sinusitis, of intrinsic (bacterial) asthma, the low-grade infection associated with glomerulonephritis, and many other sub-acute, chronic, or recurring infections.—GYÖRGY, P., EVANS, J. W., ROSE, E. K., PERLINGIERO, J. G., and ELIAS, W. F.: Oral penicillin. *Pennsylvania M. J.* 49: 409-416, January 1946.

MANAGEMENT OF COMMON EYE, EAR, NOSE, AND THROAT CONDITIONS IN NAVAL PRACTICE¹

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The purpose of this article is to present some of the more common eye, ear, nose, and throat conditions of clinical importance to the naval medical officer not trained in the specialty who may be assigned to independent duty, and to discuss the practical measures necessary to facilitate their effective management.

EYE EMERGENCIES

Foreign bodies of the lids and cornea.—Foreign bodies of the lids, especially the upper, are commonly encountered. These are easily removed with a sterile cotton-tipped applicator firmly wound and moistened with tap water. The procedure will be simplified if the patient looks down when the upper lid is exposed and vice versa.

Foreign bodies of the cornea should not be examined without proper illumination, a suitable local anesthetic (2-percent pontocaine hydrochloride solution), and a binocular loupe. When the foreign body is difficult to locate, it can be readily visualized with fluorescein (2-percent) stain, one drop instilled in the eye, and the excess flushed out with 4-percent boric acid solution or tap water. The first attempt at removal may be made with a moistened cotton applicator unless the foreign body is imbedded, in which case a blunt or sharp-pointed foreign-body spud is employed. Rust rings which are formed by a metallic particle should be scraped clean. After the removal has been completed the cornea is stained with fluorescein to determine the extent and location of the epithelial defect. If a central stain appears it is advisable to apply a cover bandage to the eye. Where the epithelium has been extensively damaged by a difficult removal 1-percent atropine sulfate solution is routinely used once or twice a day as a precaution against iritis or corneal ulceration. Cold boric acid compresses are applied four times daily and dark glasses worn

¹ Presented at the regular Staff Conference, U. S. Naval Base Hospital No. 13, March 1945.

until the irritation and photophobia have subsided. The atropine may be discontinued after 24 to 48 hours and the patient observed daily until the pupil and vision have returned to normal.

In corneal abrasions with no evidence of a foreign body the treatment is the same as described above.

External injuries.—Multiple foreign bodies are caused by welding, explosions, dust, etc. When the particles become imbedded in the bulbar conjunctiva routine attempts at removal are generally unsuccessful. Except for their cosmetic appearance no harmful effects are produced. Penicillin in dilution of 2,500 units per cubic centimeter may be instilled in the eye four times daily to prevent secondary infection.

Burns, due to explosions, liquid gases of chemical warfare, and caustics, require an immediate irrigation of the eye within 15 minutes after the injury using large volumes of a bland solution such as 2-percent sodium bicarbonate or tap water. It may be necessary to instill several drops of a 2-percent pontocaine hydrochloride solution to relieve the lid spasm, pain, and lacrimation. Blebs from vesicants such as mustard gas or Lewisite should be opened immediately, drained and freely irrigated. Atrophine sulfate in 1-percent solution is generally employed in the event of a secondary iritis or corneal ulceration. Frequent instillations of mineral oil and iced boric acid compresses are applied every 4 hours for 15-minute intervals. Local anesthetics are not to be employed more often than four times a day. The use of cocaine is avoided whenever possible since it produces an edema of the corneal epithelium and serves to delay healing.

Minor lid burns are treated as first-degree burns of the skin. In the presence of second- or third-degree burns the lid margins are sutured together in order to prevent contracture scars.

Wound lacerations of the conjunctivae often require sutures and the eye is left uncovered. Penicillin in dilution of 2,500 units per cubic centimeter, may be used locally once or twice daily and the sutures removed on the fourth or fifth day. Lacerations of the lid margins are carefully approximated to prevent lid deformities.

Intra-ocular damage.—Intra-ocular injuries arising from blast concussions, fractures of the bony orbit or skull, direct crushing blows, and metallic foreign bodies demand immediate shock therapy and penicillin administered intramuscularly in large doses. A pressure bandage is applied to the injured eye and removed only for examination. The visual acuity of the uninjured eye is tested daily for possible sympathetic involvement. Enucleation or evisceration of the damaged eye can be safely delayed for a period of several days until the patient is hospitalized.

INFLAMMATORY DISEASES OF THE EYE

Lid infections.—In the acute stage of a meibomianitis, hordeolum, or chalazion, hot boric acid compresses are applied every 3 to 4 hours for 15 minutes until either localization or resolution takes place. A lid or meibomian abscess should be allowed to point before it is incised and drained.

The common site for a chalazion is the lower lid. The infection is encapsulated and may be located either on its outer or inner surface. The former is less common and requires excision. The latter occurs more frequently and is incised and drained through the tarsal-conjunctival surface as follows: Two percent pontocaine hydrochloride solution is instilled into the lower cul-de-sac for local anesthesia and repeated at 5-minute intervals for three doses. After 15 to 20 minutes have elapsed the lid is everted between the thumb and index finger and a cotton-tipped applicator moistened with solution of epinephrine hydrochloride, 1:1000, is topically applied to the site of the chalazion. A vertical stab incision is made through the tarsal plate into the abscess cavity. The contents are curetted with a chalazion- or small ring-curette followed by an irrigation with 4-percent boric acid solution. Frequent cold compresses during the next 24 hours may be applied to reduce the lid swelling. The routine use of a chalazion clamp is to be avoided because it tends to produce additional trauma.

In repeated infections of the lids, latent refractive errors should be investigated as probable contributing factors.

Acute catarrhal conjunctivitis.—This condition is commonly observed and responds readily to local treatment. Routine smears and cultures are taken to determine the bacterial flora present. Hot boric acid compresses are followed by local instillations of penicillin, 2,500 units per cubic centimeter, four times daily. Dark glasses are prescribed for constant wear until the symptoms subside. In recurrent attacks all foci of infection and latent refractive errors should be examined to determine the underlying cause.

Epidemic kerato-conjunctivitis.—This disease often occurs in epidemic form at shore based installations and shipyards. The etiology is believed to be of virus origin with secondary non-hemolytic streptococci and staphylococci invaders. The symptoms are ushered in with the rapid onset of pain, photophobia, lacrimation, swelling of the lids and acute inflammation of the conjunctivae with small marginal ulcerations of the cornea. In the more severe cases there are constitutional symptoms with tender swollen preauricular glands. The infection may begin unilaterally and frequently becomes bilateral.

The vision is found to be reduced by the haziness of the cornea in the affected eye. A fluorescein stain introduced after the use of a local anaesthetic will determine the extent of corneal involvement present.

The treatment consists of iced boric acid compresses applied every 3 hours to reduce episcleral congestion and pain. Atropine sulfate in 1-percent solution is employed three times daily in the event of an iritis. Triple typhoid vaccine is administered intravenously in doses from 30 to 75 million organisms per cubic centimeter depending upon the degree of systemic reaction produced. An initial dose of 30 million organisms followed by a poor febrile reaction with a slight chill should be increased to a dose of 60 million the next day. A temperature rise to 104° F. is considered a favorable response. Penicillin, 20,000 to 40,000 units administered intramuscularly every 3 hours, will serve to limit the extension of the disease. Dark glasses are to be worn constantly until the infection subsides. Atropine may be discontinued as soon as the corneal lesions show no further staining with fluorescein. Visual acuity is tested daily until the patient is discharged to duty.

It has been observed that the infection shows a marked tendency to recur in the tropics, due largely to the activating effects of sun glare and road dust. Despite treatment the disease usually runs a protracted course of from 3 to 6 weeks' duration.

Sensitivity to penicillin instilled in the eye has been occasionally manifested by an increased swelling of the lids, photophobia and lacrimation.

FUNCTIONAL DISORDERS OF THE EYE

Refractive errors.—Refractive errors are frequently overlooked as an underlying cause of ocular fatigue symptoms. Patients with headache should be routinely questioned as to the presence of blurred vision when reading, writing, or at the movies, and examined for a refractive error if these symptoms exist.

Photosensitivity.—Retinal sensitivity with marked photophobia is often induced by the sun glare particularly in the tropics. In addition to the relief that may be obtained with dark glasses, fractional exposures to the sunlight beginning with ½-minute intervals and gradually increased to a tolerance threshold may prove beneficial. Thiamine hydrochloride administered in daily injections of 50 grams subcutaneously may prove helpful.

Allergic conjunctivitis.—This condition is commonly encountered in tropical climates due to the perennial foliage and high pollen content in the air. Repeated episodes of itching lacrimation and conjunctival hyperemia are characteristic manifestations. During the attack frequent iced boric acid compresses and 1 drop of epinephrine hydrochloride, 1 : 1,000 solution, instilled into the eye will often afford

palliative relief. Repeated attacks with a recurrence of symptoms should warrant a transfer to a temperate climate or sea duty.

EAR EMERGENCIES

Examination.—The diagnosis and treatment of ear conditions may be simplified by a few precautionary measures employed in the examination as follows:

1. An ear should not be examined without proper illumination from an otoscope or head mirror.

2. The size of an ear speculum properly selected to fit the canal will provide an adequate view for examination and avoid the possible danger of added trauma.

3. An inspection of the drum should not be attempted unless the canal and the surface of the tympanic membrane have been carefully cleaned.

4. Cerumen hooks and ear curettes used for the removal of wax should generally be avoided in preference to an ear irrigation except where a perforation of the drum is suspected.

Foreign bodies in the external canal.—Live insects in the external auditory canal such as flies, moths, ants, etc., produce acute sensations of auditory distress and pain due to the intensity of their vibrating sounds and movements against the drum surface. The treatment consists of a few drops of chloroform instilled in the canal and followed by an ear irrigation. When chloroform is not available, mineral oil or alcohol may be used.

Traumatic perforations of the drum.—A direct blow to the canal or an explosive blast may produce a sudden rupture of the drum followed by tinnitus and deafness. The immediate treatment for the tinnitus is sedation and a cotton plug inserted in the ear to prevent further exposure to loud noises. A small perforation will usually heal within a short period of time. Large perforations may be stimulated to epithelialize with 50-percent silver nitrate solution applied to the edges on a slightly moistened cotton-tipped applicator once or twice a week. The persistence of tinnitus and deafness indicates cochlear damage involving the organ of Corti. Hearing tests and serial audiograms will determine the degree and progress of the auditory nerve impairment.

Aero otitis.—This condition frequently occurs among flying personnel and submarine workers. The attack is ushered in with the onset of a sudden lancinating pain in the ear and deafness, resulting from the individual's failure to equalize the middle ear pressure during a rapid descent from high altitudes or an ascent from deep sea diving. The contributing factors may be due to either an acute upper respiratory infection, or a past history of middle ear disease followed by

repeated episodes of eustachian tube blocking, or the physiological inability to "clear" sensations of recurrent ear blockage.

An examination of the affected drum will reveal various stages of retraction, with alterations in the middle ear cavity ranging from a mild hyperemia and serous fluid to frank hemorrhage or rupture of the drum, depending upon the degree of negative pressure exerted. The latter condition, although rare, may follow a steep dive-bombing run on a target or a rapid descent in a low-pressure chamber.

Immediate treatment consists of nasal shrinkage followed by positive air pressure which is directed into the middle ear cavity via the nasal airway and eustachian tube. The patient is instructed to take a sip of water, hold it in his mouth and swallow at the same moment that air pressure is forced through a Politzer bag or DeVilbiss Pressure Vaporizer into the nasal cavity with the free nostril pinched off. This procedure is repeated two or three times daily. One-half-percent neosynephrine hydrochloride nose drops are self-administered by the patient three times a day with the head in a lateral low position, to help increase nasal ventilation and eustachian tube patency.

When fluid persists in the middle ear after 3 days of treatment a paracentesis is indicated. An effective local anesthetic for the purpose consists of 20 grains each of cocaine, menthol, and phenol, and 15 minims of chloroform. A small pinch of cotton, loosely rolled on a metal applicator to form a pledget, is moistened in the solution, and placed against the posterior half of the drum with ear forceps. Complete anesthesia is manifested by a blanching of the underlying surface area in approximately 15 to 20 minutes. When the drum is punctured, air immediately enters the middle ear cavity followed by an escape of the entrapped fluid with prompt relief of the pain and deafness.

After treatment consists of 1/2-percent neosynephrine hydrochloride nose drops used four times daily and frequent auto-inflation or valsalva by the patient. Flying personnel and submarine workers are temporarily grounded until the condition has completely subsided. When a spontaneous rupture of the drum has taken place there is no local treatment other than to keep the canal clean.

Blebs.—Bleb formations of the canal or drum are a common occurrence and usually virous in origin. The main symptom is a severe lancinating pain in the ear, sudden in onset. The treatment consists of a paracentesis of the bleb with the local aid of the aforementioned anesthetic. Relief is obtained immediately following the release of the fluid tension. The canal is wiped dry, insufflated with sulfa powder and a gauze ear wick inserted. The patient should be watched daily for the possible development of an acute external otitis or an acute otitis media. Chemotherapy will serve to limit the progress of secondary infection.

INFLAMMATORY DISEASES OF THE EAR

Fungous infection.—This disease is highly prevalent in tropical climates where excessive perspiration, heat, and humidity favor the abundant growth of the mycotic organisms. Individuals are particularly susceptible to the infection in the absence of adequate bathing facilities or when exposed to contaminated bathing beaches. The symptoms are manifested by a constant itching, redness, and foul discharge in the canal.

Treatment consists of cleansing the canal with a mixture of 15 grains of boric acid in 1 ounce of 70-percent alcohol followed by an insufflation of sulfa powder. The patient is instructed to keep his head out of showers and advised against swimming. If these precautions are carefully observed the condition will respond rapidly to treatment.

Acute external otitis.—In the persistent or neglected cases of fungous disease with excoriations of the skin lining the canal, acute secondary infections are frequently introduced by picking or scratching at the external auditory meatus. The chief symptoms are pain and a generalized tenderness which vary in relation to the degree of inflammatory involvement present.

The most effective treatment in the early stages of the infection is x-ray therapy. When x-ray therapy is not available, however, sterile gauze ear wicks saturated with 4-percent boric acid solution are loosely inserted into the canal and followed by lamp heat exposures for 10-minute intervals, three times a day. Penicillin therapy administered intramuscularly will hasten early resolution of the infection. Cotton wicks employed in the canal are to be avoided if possible, as they tend to retard adequate drainage. Ointments are equally ineffective since they are not readily absorbed in the presence of a discharge.

Furuncles.—This infection arises in the cartilaginous part of the canal where hair follicles are present. The symptoms and findings are often difficult to differentiate from an acute external otitis, except that with a furuncle there is usually a maximum point of tenderness.

The treatment is essentially the same as outlined before. Continuous, hot flaxseed poultices, whenever available, will effectively serve to localize the infection. Furuncles should never be incised, but permitted to rupture into the canal.

A preauricular swelling with pain in the ear and a noninflammatory narrowing of the canal lumen are frequently the early signs of an acute infectious parotiditis and should be differentiated from those of a furuncle by repeated daily white blood and differential counts.

Acute middle ear disease.—The pathway of infection in acute

otitis media is commonly recognized as via the nasal tract and eustachian tube. The etiology is usually an acute upper respiratory infection or a swimming episode. The predominant symptoms are pain and deafness. In the early, acute catarrhal stage the drum membrane appears hyperemic and retracted.

Treatment consists of nasal shrinkage four times a day to provide increased ventilation of the nasal airways and middle ear cavity. Warm, massive ear irrigations with 500 cc. of physiologic saline solution administered slowly to the drum every 3 hours will alleviate the pain and encourage resolution. Penicillin, 20,000 units administered intramuscularly every 3 hours, will tend to prevent complications. The presence of serous fluid in the middle ear cavity is an indication for a paracentesis of the drum to establish drainage and a return of normal hearing.

The persistence of aural pain with a pulsating discharge of 2 weeks' duration suggests an acute involvement of the mastoid and warrants hospitalization for further treatment.

Chronic suppurative middle ear disease.—This condition occurs with surprising frequency notwithstanding the rigid entrance physical requirements. The known causes are the early infectious diseases of childhood, such as scarlet fever and measles. The symptoms and physical findings are a recurrent aural discharge, foul in odor, a perforation of the drum, and a loss of hearing. X-rays of the mastoids will usually reveal sclerotic bone changes on the affected side.

The treatment consists of boric acid and alcohol cleansing of the canal once or twice daily followed by sulfa powder insufflations. A dry, sterile gauze ear wick is inserted into the canal to maintain drainage. Diseased granulation tissue around the edges of the perforation or in the middle ear cavity will maintain an active discharge and therefore should be cauterized with 50-percent silver nitrate solution topically applied about every fourth day with a slightly moistened small tipped cotton applicator.

Chronic non-suppurative middle ear disease.—Acute exacerbations of a chronic nonsuppurative otitis media are commonly precipitated by an acute upper respiratory infection or swimming, and upon examination show a pulsating mucoid discharge. Local treatment consists of applying gauze ear wicks in the canal moistened with 4-percent boric acid solution and frequent nasal shrinkage. Wet treatment should be discontinued as soon as the discharge has lessened and dry treatment carried on, with sterile gauze ear wicks and sulfa powder insufflations. The patient should be warned against future swimming.

Chronic middle ear infections, despite treatment, show a marked tendency to recur in tropical climates. It is doubtful whether the

expense and loss in man-hours entailed in the treatment of these cases warrants their retention in the service.

FUNCTIONAL DISORDERS OF THE EAR

Referred pain to the ear.—The symptom of pain in the ear with no evidence of organic ear disease is relatively common in personnel between the age of 17 to 20 years. A careful dental examination of this age group will often reveal an impacted or unerupted molar as the underlying cause. Apical infections and temporo-mandibular joint disturbances due to malocclusions are also frequent causes of referred ear pain. Complete x-rays of the mouth and temporo-mandibular joints are indicated when these conditions are suspected.

Internal ear disorders.—Vestibular disturbances unassociated with deafness, are manifested by the sudden onset of vertigo, nystagmus, nausea, and vomiting dependent upon the degree of stimulation and irritability of the labyrinth. Audiometer and vestibular function tests will determine whether the symptoms are of functional or toxic origin. When the results show a relative hypo- or hyper-irritability of the labyrinths, it is advisable to recommend limited shore-duty.

In labyrinthitis of toxic origin there is also involvement of the cochlea with resulting nerve deafness. These cases are unfit for duty and warrant a survey out of the service.

EMERGENCIES OF THE NOSE

Epistaxis.—Nasal bleeding may be caused by various factors such as a direct blow to the nose, an acute upper respiratory infection, septal ulcerations from exposure to chronic acid fumes, or more uncommonly a telangiectasis of the septum. The source of the bleeding is usually found in the most anterior middle part of the septum, known as Kiesselbach's area, but may arise also from the septum, floor, or inferior turbinate in the posterior nares. When there is profuse bleeding from Kiesselbach's area a plug of cotton is placed in the nose and the patient instructed to apply digital pressure over the nostril while preparations are made to cauterize the bleeding point with a chromic acid or silver nitrate bead. These are prepared by fusing several crystals of either caustic agent on the end of a metal applicator over a low flame. Direct contact with the flame is to be avoided as it will destroy the bead. After the bead has been prepared a pledget of cotton, moistened in equal parts of epinephrine hydrochloride solution, 1:1000, and pontocaine hydrochloride, 2-percent solution, is applied to the bleeding point where it is allowed to remain for several minutes prior to cauterization. Topical application of the bead to the bleeding point is followed immediately by an eschar of the mucous membrane. The patient is instructed not to blow his nose for the next 24 to 48

hours and to draw the nasal secretions into his throat for expectoration.

In the event of failure to control the hemorrhage or locate the source of bleeding, the nasal cavity is firmly packed with a long strip of narrow 1/4-inch vaselin gauze in successive layers which are carried all the way to the posterior choana and allowed to remain for 24 to 48 hours. Supportive measure consisting of intravenous plasma and intramuscular injections of penicillin may be administered.

Fractures of the nasal bones.—These emergencies are generally transferred to the hospital for treatment and disposition. However, their frequent occurrence in the line of duty warrants a brief description of their management.

Direct trauma sustained to the bridge of the nose which is followed by pain, swelling orbital ecchymosis, and external deformity, indicates a simple or comminuted fracture of the nasal bones. X-rays of the nose should be taken in the lateral and vertical positions to determine the degree of displacement. Reduction of the fracture must be performed as soon as possible after the injury or within a period of 5 days to allow for the subsidence of tissue swelling and traumatic reaction. X-rays of the nose following reduction will determine the proper alinement of the fragments.

In a compound fracture of the nasal bones the wound should be debrided with as little sacrifice of tissue as possible for cosmetic reasons, and left open until the fracture has been reduced. Penicillin therapy should be employed to prevent complications.

INFLAMMATORY DISEASES OF THE NOSE

Upper respiratory infections.—Acute upper respiratory infections of the common cold variety are relatively infrequent in the tropics. Acute exacerbations of a pre-existing chronic sinusitis are, however, often observed. A protracted head cold of 2 weeks' duration with periodic headaches usually suggests a complicating sinusitis. The treatment consists of bed rest, neosynephrine hydrochloride 1/2-percent nose drops and the local administration of penicillin, 25,000 units per cubic centimeter, in each nostril four times a day. Chemotherapy is routinely employed.

Furuncles.—Furuncles of the nasal vestibule are treated with continuous hot compresses and penicillin intramuscularly. The furuncle should never be incised or squeezed but allowed to localize and rupture spontaneously into the nares. The vibrissae are clipped short to permit adequate drainage into the nostril. Five-percent sulfa-thiazole ointment or penicillin compresses (25,000 units per cubic centimeter) may be applied locally.

FUNCTIONAL DISORDERS OF THE NOSE

Allergic rhinitis.—Allergic disorders of the nose are prevalent in the tropics, and are aggravated by exposure to the foliage, excessive heat, and humidity. The milder attacks may be moderately controlled with the aid of a benzedrine inhaler and $\frac{3}{8}$ -grain propadrine hydrochloride capsules taken orally one-half hour before meals and at bed time. The more serious cases with nasal polypi and persistent nasal obstruction are, however, a difficult problem for treatment and should be recommended for duty in a temperate climate. Sea duty is not advisable because of the variable weather conditions and their greater susceptibility to upper respiratory infections.

THROAT EMERGENCIES

Edema of the larynx.—This condition is fortunately uncommon in occurrence. However its principal consideration arises from the ever present possibility of sudden asphyxia with a fatal termination unless quickly and decisively treated. The etiology may be an injury to the neck involving the larynx, accidental swallowing of caustics, or the inhalation of acid fumes and chemical gases of warfare.

Immediate treatment consists of sedation, ice compresses to the neck with the patient semipropped up in bed, steam inhalations with compound tincture of benzoin and complete voice rest. If the dyspnea becomes steadily worse it will necessitate an immediate tracheotomy.

Ludwig's angina or an acute cellulitis of the floor of the mouth following a dental extraction may also produce laryngeal edema with impending respiratory obstruction. Penicillin, 40,000 to 50,000 units every 3 hours intramuscularly, combined with sulfa therapy should be administered. Continuous hot compresses applied to the neck will help to localize the abscess and encourage a spontaneous rupture into the pharynx.

Allergic, vasomotor, or angioneurotic disturbances are additional causes of laryngeal edema. Ten minims of epinephrine hydrochloride, 1:1000 solution, injected subcutaneously usually reduces the laryngeal swelling and affords immediate relief from the respiratory embarrassment.

INFLAMMATORY DISEASES OF THE THROAT

Acute nasopharyngitis.—This infection is commonly a cause of fever, protracted sore throat, occipital headache, and swollen neck glands. The presence of this disease, however, is often overlooked due to its location and the failure to perform a routine mirror examination of the postnasal space. A careful inspection of the posterior pharyngeal wall and nasopharynx will reveal an acute follicular

edema of the lateral pharyngeal bands, located behind the posterior pillars of the tonsil, and the presence of an inflammatory exudate disseminated over the posterior nasopharyngeal wall.

Treatment consists of nasal shrinkage with a 1/2-percent aqueous solution of neosynephrine hydrochloride followed by warm 1-percent saline nasal douches administered four times a day through a large eye dropper held horizontally first into one nostril and then the other with the patient's head tilted slightly forward. The expressed fluid is drawn into the nasopharynx by the patient and hawked out. A more effective method for the removal of the postnasal exudate is the use of a suspended irrigating apparatus containing 250 cc. of a warm slightly hypertonic, saline solution introduced into the nose by means of a glass dropper connection, with the patient breathing through the mouth and the head tilted slightly forward. Penicillin, 20,000 units administered intramuscularly every 4 hours, will limit the progress of the infection.

FUNCTIONAL DISORDERS OF THE THROAT

Smokers throat.—Excessive smoking is particularly prevalent under conditions of military stress and frequently disregarded as the commonest contributing cause of repeated attacks of sore throat. Treatment of all throat disorders should include the necessary control of this factor.



INCIDENCE OF LEUKEMIA IN RADIOLOGISTS

Author's summary.—A statistical study of 34,626 obituary notices in the *Journal of the American Medical Association* covering the 10-year period from 1935 to 1944, reveals that the incidence of leukemia among 205 physicians listed as radiologists was 3.9 percent, which is more than eight times as great as the incidence (0.44 percent) among those not listed as radiologists.

This marked difference is substantial evidence that exposure to radiation is a potential cause of leukemia.

A case of lymphatic leukemia in a dermatologist who failed to take adequate precautionary measures against radiologic exposure is reported.—ULRICH, H.: Incidence of leukemia in radiologists. *New England J. Med.* **234**: 45-46, January 10, 1946.

CARE OF THE PARAPLEGIC'S URINARY TRACT ¹

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When the United States Navy decided to care for its paraplegic casualties in various centers instead of treating them in general hospital wards, not alone did the morale of these patients improve immediately, for they were quick to appreciate the advantages of segregation, but the medical profession also benefited by having large series of cord bladder cases made available for study.

The urological care of 1 such group of 87 patients was commenced by Comdr. G. J. Thompson (MC) U. S. N. R. and Lt. Comdr. M. H. Nourse (MC) U. S. N. at the United States Naval Hospital, Santa Margarita Ranch, at Oceanside, Calif., and has continued at the United States Naval Hospital at Corona, Calif.

In civilian practice, because the most frequently encountered cord bladder is the tabetics, the term has become almost synonymous with the idea of a thin-walled atonic viscus incapable of emptying itself while constantly overflowing, to the continued distress of both the patient and the olfactory sense of his friends.

This type of bladder is seldom encountered, following trauma to the spinal cord. In such cases after a lapse of a few months the bladder walls thicken, the musculature tends to spasticity, and the mucosa shows marked trabeculation. Such a bladder, if the obstruction at the vesical neck is not relieved, usually fills to a certain capacity, then at frequent and unpredictable times spurts out an ounce or two of urine as the musculature contracts.

This continues for several months and in the interim the bladder must be drained in order to prevent secondary infection from urinary obstruction.

In theory, catheterization at regular intervals should be satisfactory but nowhere is theory and practice so far removed. Under the best of nursing, the time comes when the bladder inadvertently

¹ Read before the Western Section of the American Urological Association, 1 May 1946.

becomes overdistracted. This overstretching of its musculature not alone injures its tone but subjects it to trauma from the overdistension seen so frequently following general surgery and invariably followed by febrile reactions.

This same criticism applies to the widely-heralded and advertised tidal drainage. The theory is perfect, the clinical application doomed, in the long run, to failure. In the case of battle casualties where various methods of transportation must be considered, a suprapubic drain is the only insurance against obstruction and infection. The casualties that arrived with suprapubic drainage at our paraplegic center were in better condition than those without such drainage.

In civilian practice, or in a paraplegic center when proper nursing care and observation are available, much can be said in favor of drainage through the urethra.

In reporting the result of treatment in cord bladder cases a definition of terms is imperative.

When the bladder empties by reflex action, as in infancy, we term it automatic, and if the patient can initiate the act we speak of it as voluntary.

In respect to the automatic bladder, if one recalls that during infancy, the action of the bladder is due to a reflex center in the conus medullaris of the cord and that this center is situated in the region of the twelfth thoracic and first lumbar vertebrae, he can more easily appreciate the relationship between the level of the various spinal-cord lesions and the bladder dysfunction that follows.

It is believed that during early childhood a pathway from the higher centers develops in the cord for the passage of inhibitory impulses to the reflex center so that the act of micturition can become voluntary.

In some, this inhibitory pathway develops imperfectly and we meet the enuretic of civilian life, or a sniper's bullet damages or completely destroys it and months later the automatic reflex bladder of infancy returns, provided there develops a satisfactory balance between its filling and emptying mechanism.

The height of the injury in the cord seems to predicate in a rough sort of way, the type of the bladder function that will develop. If the lesion is high, a more or less efficient automatic bladder may be expected, while if it involves the lower lumbar spine, hope for ultimate voluntary control is warranted.

Because traumatic lesions of the cord are so frequently followed by more or less spasticity of the bladder muscles and the urethral sphincters, satisfactory emptying of the bladder depends on the ability of the detrusor muscles to overcome whatever obstruction the sphinc-

teric muscles exert. It is the removal of this obstruction by transurethral resection that enables certain or both the automatic and voluntary types of bladder to function. In some so delicate is the balance between the emptying and retaining mechanisms that only a few grams of tissue needs to be removed to bring satisfactory results.

About one-half of our cases, 37 to be exact, have bladders which function automatically. In 16 of those the removal of tissue from the bladder neck was necessary before the bladder was able to act efficiently. Included in this group are 7 patients who, once the bladder commences to automatically contract, can assist its complete emptying by straining with the abdominal muscles.

Among the 21 other patients with this type of bladder action, 1 or 2 ounces of residual urine may be present most of the time. However, if the urine is clear we have not felt it expedient to attempt to free them of this small amount of residual by transurethral resection. We reserve the operation for those who are unable to expel any urine or in which many ounces of residual urine remain. Following the use of streptomycin 5 members of this group, even in the presence of this small residual, now pass sterile urine, and in the entire group 33 now pass sterile urine on voiding.

That the act of micturition can be successfully initiated or voluntarily controlled by those who have had a complete severance of their spinal cord above the conus has not been observed by us. Instances concerning the stories of a trigger mechanism or condition reflex, where the patient strokes his thigh and the bladder empties, have not been observed among our sailors or marines.

For those who paradoxically were fortunate enough to be hit below the conus in the sacral or lumbar region the possibilities of obtaining a voluntary bladder mechanism are excellent. Inhibitory tracts from the higher centers to the conus are still intact although the reflex spinal center may be injured more or less completely. The task of the urologist is to model the bladder neck by transurethral resection so that the sphincteric mechanism will be sufficiently weak to permit the passage of urine at the time the patient desires. If the innervation to the detrusors has been completely or partially destroyed the paraplegic can frequently empty his bladder by voluntarily increasing the intra-abdominal pressure through the control of his abdominal muscles. In 29 of them transurethral resection was necessary before they obtained voluntary function.

In these paralyzed patients, healing following resection is slow and late bleeding is often present, not infrequently due to the spasticity of the muscles involved. Therefore we feel it better to always remove a minimum of tissue even if a second or third resection is required.

Three of our cases have been resected three times and one of these cannot yet void, though all obstruction is apparently removed. Explanation of such failures is difficult but engaging.

Hypercalcinuria is another phase of the urologist's problem in the care of the paraplegic. How rapidly calcium can disappear from the skeleton of an inactive patient by way of the urinary tract forming calculi on the way can only be appreciated by examining series of x-rays and observing the patient's urine.

Routine x-ray and cystoscopic examinations are mandatory in detecting stones early in their formation, for these individuals have little sensation in their urinary tract and an elevated temperature is usually the first sign that obstruction from calculus has occurred.

By teaching these patients the importance of a large fluid intake in keeping the urine diluted and the still greater importance of changes in their position in avoiding urinary stasis in the kidney pelves, together with acidifying the urine by mandelic acid, we have been fortunate in having only 14 patients so far form stones in their upper urinary tract.

These we have treated conservatively, passing catheter to relieve obstruction as soon as febrile reactions indicates its presence.

Stone-dissolving agents have been employed but their efficacy has proved unpredictable. In some the stone dissolved and disappeared in a matter of days, in others the calculi increased in size and density while bathed in the solutions.

In the care of the paraplegic the use of such solutions means more time spent in bed and more time in bed for the paraplegic means not alone more loss of calcium from idle bones but more serious loss of muscular strength in unparalyzed muscles which are so needed in the successful use of braces and crutches.

The urological care of the paraplegic, important and as vital as it is, comprises only a portion of his treatment. The neurological surgeon is equally essential, while the plastic surgeon has a problem in the care of the decubitus ulcers that, even with the great technical strides that have been made in plastic surgery, he has not yet been able to completely overcome. All, however, would be of little avail were it not for the Navy nurses' and hospital corpsmen's devotion to duty, the details of which are daily often far from stimulating.

EMERGENCY SURGICAL MEASURES ABOARD AN APA DURING AN AMPHIBI- OUS INVASION

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Wartime surgery differs but very little from that of a large industrial practice during dangerous construction work. The difference seems to be in the terrific nervous strain on the part of both the surgeon and the patient. Evidence aboard ship, under fire either from air attack or from enemy shore batteries, would point to greater nervous tension among the personnel working inside the ship than with those out on deck. This would suggest that during the firing, if a human target can see what is going on he is not nearly so tense as when he can only hear the terrific sound of shell fire with resultant ship vibrations and thus is constantly on guard in his apprehensive nervous system for either shell, bomb, or torpedo to come through the side or top of the ship. In order to keep the explosive dangers to a minimum and also to avoid loss of priority supplies, the medical department disperses its equipment throughout the length of the ship, but always attempts to keep the medical gear quickly accessible to main operating units as well as to battle dressing stations, both forward and aft. Large oxygen tanks are secured in steel brackets at the head of each operating table.

During general quarters, when under attack, or at abandon ship, in order to avoid confusion and traffic congestion of personnel, everyone works at a definite station and the individual only, when necessary, moves always up and forward on the starboard side and down and aft on the port side of ship.

Casualties are brought on board chiefly in boat loads lifted directly to the open double doors leading into the large officers' ward room which is all prepared to be used as receiving, examining, clerical-work, and also dirty-surgery room. Here the clerical Hospital Corps officer makes out detailed reports on each patient, red-, blue-, white- or purple-type casualty and the diagnosis, as the examining doctor quickly dictates. Here in the sorting station we have a master bed chart of all bed spaces numbered, and just as soon as all clothing, life belts, etc., are removed from patient and the examination has been completed,

the same beachhead casualty tag is completely filled out, numbered with one of the available bed numbers from the master chart and white or blue patients are treated and sent to bed. If patients are red casualties (ones in serious condition, requiring 2 months' bed care, i. e., cases with compound fractures of skull or extremity, sucking chest wounds, or belly surgery, they are usually x-rayed in the ward-room sorting station and treated with blood plasma to improve their surgical-risk status. As much complete debridement, with considerable hydrogen peroxide, sterile saline irrigations as possible is done on compound-fractured extremities right in the receiving room, followed by correction of alinement, packing with sterile sulfa-impregnated vaselin gauze, placing in cast with or without traction pins, and putting to bed. This saves the main clean operating rooms for more serious compound skull or belly surgical cases. The practicality of this plan was particularly gratifying when at one time two full boatloads of very serious casualties came aboard and we were able to take the most serious surgery into the main operating units, especially saved for just such an occurrence.

During this invasion over a concentrated 2-day period including all of 1 night, extremely serious patients representing a combination of varied pathology were received. These included compound fractures of skull, compound fractures of extremities (both upper and lower), bullet fractured spine, abdominal surgery, and bullet transfixion of both sides of scrotum.

The majority of the cases received during the first day of the invasion were white and blue casualties. All of them were cleaned and dressed, checked for tetanus antitoxin, severe dirty wounds were treated with gas serum, and some operated upon, after which they were transferred later to the Marine base hospital back on the invaded island.

Sixteen of our cases included gunshot wound of mandible, gunshot wound of hip, shrapnel wounds of arm, gunshot wounds of back, shell-blast-explosion concussion of chest, gunshot wound of thigh, compound-avulsion-type fracture of hand, gunshot wound of forearm, gunshot wound of shoulder, compound fracture of femur, gunshot wounds of both feet, compound fractured humerus with deeply imbedded 31-gram shrapnel between scapula and ribs, multiple shell wounds of thigh and lower leg, shell wound of arm, and severe compound-comminuted-fractures of entire foot with "dum dum" type of bullet deeply imbedded in ankle joint.

All of these cases were cleaned up with tincture of green soap and water followed by 70-percent alcohol skin cleaning, debrided well, and irrigated profusely with sterile salt solution and hydrogen

peroxide, using syringes. All foreign steel bodies found by x-ray were removed, and every wound left open, using first sulfa crystal spray in wound and then a sterile sulfa-impregnated vaselin gauze packing for drain. When time permitted either plaster casts or posterior molded plaster splints were applied since Trueta, in Spain's war proving grounds, had proved so conclusively their worth for immobilization and safe transportation. Selected patients were encouraged to drink coffee and to smoke in order to lessen shock.

Every wounded patient was given tetanus antitoxin, provided beach tag showed none had been administered. During a thorough teaching program on the ship previous to invasion, the writer decried the overuse of morphine and the harmful cumulative action of the drug along with its masking effect on important symptoms, especially in belly work. The value of this certainly proved true during this invasion inasmuch as every patient had been administered morphine sulfate grain $\frac{1}{4}$ to $\frac{1}{2}$ on the beach and not one case required any more morphine on the ship before surgery. In fact, the further indiscriminate use of this drug on these patients would have been very harmful in its depressing action during anaesthesia and later in the production of ileus.

Due to imminent air attack we were ordered to transfer the stretcher cases to the Navy hospital ship within one-half hour's notice and thus it was impossible to complete all health records. However, on each case we had a four-page hospital chart completely detailed as to all temperatures, diets, morphine with time of shot, tetanus antitoxin, a description of pathology with operative procedure, and all developed x-ray pictures which were transferred along with each carefully tagged patient.

A full record of these patients was sent to the captain's office, a copy to the ship's log, and all necessary reports forwarded to proper place as ordered by attack force commander.

When our nonevacuable patients improved to a condition safe for transportation their status was changed to evacuable and they were transferred accordingly either to a collecting hospital ship or back to a base hospital on the beach. Some of our nonevacuable patients remained critical and necessarily had to be retained on board ship. These, with one exception, improved for safe transfer later at Saipan.

The over-all medical organization seemed to be very efficient and with the routing of patients from beach head direct to LST-H ships for rerouting to larger ships for hospital treatment, there was a minimum of time lost in appropriate treatment. Only once were we in a congested state when operating rooms were filled and wardroom tables crowded so that patients had to be sent to bed and await later attention.

This occurred at 1915 on the second day of the invasion, after we had completed the brain surgery (see case report) and, at one time, so many casualties came aboard that operating rooms, all sorting-station tables, and the x-ray table were filled with patients so that many necessarily had to be quickly checked over and sent to bed to await later surgery.

Space does not permit the writer to describe but a small number of the varied casualties, thus a brief case report will be made of only one severely wounded patient picked out of each group to show varied pathology and treatment representative of different regions of the body.

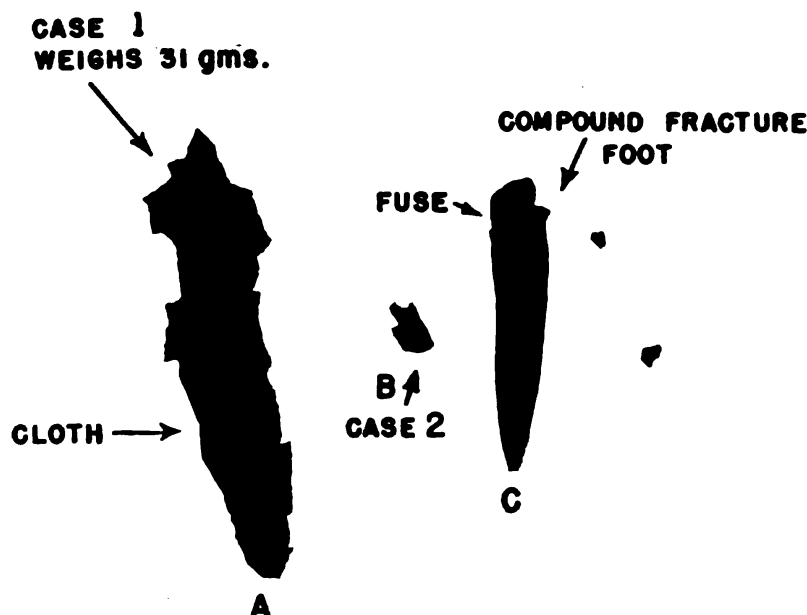
CASE REPORTS

Case 1.—Patient was 23 years of age and had B. P. 100/70; T-103°; P-120; R-26. Patient was knocked out with shrapnel, which produced compound fracture of right humerus. He was transferred directly from red beach to LST-H and immediately on to our ship, standing directly off beachhead. X-ray examination showed compound fracture right humerus, satisfactory position, and with a large shrapnel body having ricocheted off humerus and lodging deeply posterior between scapula and ribs. Patient treated with T. A. T., and blood plasma instituted for shock. Thorough debridement, irrigation of wound with sterile saline solution and the large shell found so deeply imbedded that it was impossible to remove. With so many casualties awaiting treatment, the wound was quickly and deeply packed with sulfa-vaselin gauze directly down to shrapnel, dressed, the arm splinted and the patient sent to bed with follow-up I. V. fluids. The following morning, when there was an open hour's time, the patient was again operated upon, all packing removed, and the steel fragment carefully freed and it was now possible to remove the jagged, razor-sharp edged shrapnel which weighed 31 grams. Surrounding the shrapnel and burned into the steel was some green cloth which had been driven down into the wound (A, fig. 1). This large steel foreign body was 10 inches from its entrance wound on the arm and was imbedded deeply under the lateral aspect of the scapula. The wound was again irrigated with peroxide and repacked deeply into the sinus with vaselin gauze. Patient placed in Velpeau bandage for splinting and had normal convalescence. Condition safe for later transfer to hospital ship.

Case 2.—The patient was knocked over backward by a shot to his chin. Only pathology here was marked swelling of lower jaw and mouth. X-ray examination showed small steel body deep against mandible (B, fig. 1). Steel fragment quickly removed by surgery, wound irrigated and packed open with vaselin gauze. Responded well and safe for transfer later to hospital ship.

Case 3.—Condition: Severe and extensive compound-communited-depressed fracture of skull with basal fracture, avulsion of all three layers of dura at point of explosion, avulsion of brain tissue, and patient in severe shock and coma. This patient was operated on immediately. Blood plasma administered while scalp was shaved. It was noted with dismay that this patient was struck by a high powered explosive on 1 April 1945 at 1900. His buddy stated that they had no available transportation for patient and that he had to remain in his critical state all that night in the fox hole! Furthermore, this boy had thrown away his steel helmet before the bullet struck his head.

His buddy who suffered compound fracture of elbow joint and came to our ship for surgery (Case 7) stated that he thought Case 3 would die during the



(Photographs smaller than actual size.)

1. Various types of Japanese shell fragments removed from wounded Marines aboard ship during first 3 days of invasion of Okinawa.

(A) Razor-sharp edged shrapnel fragment, weighing 31 grams, with cloth burned into shell and carried 10 inches into body of patient (Case 1). The rough edges caused this large iron casting to be wedged so firmly and deeply between scapula and ribs that two operations were necessary to remove it. First stage packing down to shell and second stage removal of shell with no further injury to vital structures.

(B) Curled copper casing removed from mandible (Case 2).

(C) Characteristic Japanese tin-covered 30-mm. machine-gun, high-velocity bullet, having terrific explosive and destructive power. This bullet was removed from the ankle joint after it had traveled $7\frac{1}{2}$ inches through the foot, causing six compound fractures before ending up in the ankle joint. This patient was in condition for early transfer and is not reported in case studies. The unusual amount of bone destruction here was possibly due to a tricky delayed fuse in base of bullet. Some of the Japanese wooden bullets also have unusual destructive power.

night. The following day these men were transported back to red beach where first aid was rendered at 1100 on 2 April 1945. At 1225 on that day the patient arrived aboard our ship in a critical state, $17\frac{1}{2}$ hours after the initial serious injury. Obviously there was no longer any 6-, 8- or 10-hour safe period for desirable surgery, but due to the severity of injury with its deeply depressed bone fragments down into brain, an operation was done as quickly as possible under local novocaine anesthesia and with no further shock reaction. In fact, with the use of blood during surgery, the patient left the operating table in an improved condition. It was further noted that this ugly wound, down into the brain, remained clean, sweet, and noninfected all through his later course.

He was nonevacuable and could not safely be transferred off the ship before it was quickly ordered away from target area to avoid further air attacks.

The writer noted here that with so much avulsed dural layers it was impossible to suture the dura together, and thus small loose fragments of bone were discarded at the time that the large depressed bone was pried up into proper position. Patient had received serum albumin and 2 units of blood plasma on beach. Physical examination showed: T-102 (axillary); P-144; R-36; BP-115/70; pupils small and equal; eyeballs everted; body warm and color good; respirations rapid and equal bilaterally; extensive hemorrhage noted in posterior portion of nose and throat; no evidence of blood or spinal fluid discharge from either ear. X-ray of skull showed: Evidence of a severe compound fracture of the skull with fracture lines extending from the junction of the sagittal and coronal suture lines inferiorly and anteriorly to cross the left orbit and enter the frontal sinus on that side; a fracture line posteriorly and inferiorly into the right occipital bone and a stellate fracture of the right occipital bone; and a depressed fragment of bone pressing into the brain in the midline of the calvarium where there was a loss of bone substance. Operative note: Sterile saline irrigation and debridement. Elevation of the depressed skull fragments and realignment. Loss of an area of bone about 2 by 4 cm. Brain substance visible through torn and avulsed dura. Hemorrhage controlled. Wound packed open with sterile sulfathiazole-impregnated vaselin gauze strips. Given 2 units of plasma on the operating table. Post-operative condition fair. No shock from surgery. Laboratory findings: RBC-2,310,000; WBC-9,700; Hgb. 48 percent. Given 500 cc. of whole blood type "O". 2 April 1945: Placed in semi-Fowler's position with ice bags to head. Nasal oxygen 6 liters per minute. Given 20,000 units of penicillin at once and 15,000 units every 3 hours. 3 April 1945: Condition remains critical. Pulse rate averages 110. Blood pressure elevated (160/100). Patient vomited a quantity of black blood. Shaking chills. Thick smear positive for malaria. Given 3 grains of atabrine intramuscularly. Laboratory findings: RBC-2,225,000; WBC-12,500; Hgb. 46 percent; Urine: R&M—normal; specific gravity—1.018. Given 500 cc. whole blood, type "O", no reaction. Given 50 cc. of 50 percent dextrose to combat increased intracranial pressure. Oxygen discontinued temporarily. Penicillin continued at 15,000 units every 3 hours. 4 April 1945: No response to any stimuli. T-104 (axillary); P-30; R-50; BP-135/85. Laboratory findings: RBC-121,000; WBC-10,500; Hgb. 65 percent. Given 500 cc. whole blood, no reaction. Penicillin increased to 20,000 units every 2 hours. Nasal oxygen sufficient. Atabrine, 3 grains intramuscularly. Spinal puncture performed, fluid moderately bloody. Not under increased pressure. Laboratory examination shows no organisms to be present in a stained smear or after culture. No WBC present. Dressing changed, wound appears clean. 5 April 1945: Temperature remains elevated; blood pressure nearing normal but pulse rate rapid. Given 500 cc. whole blood and 1,000 cc. plasma. Is incontinent per bladder. 1-2-3 enema given with good results. Five grains of sodium sulfadiazine given intravenously. 6 April 1945: Blood pressure becoming unstable. Adrenalin and caffeine and sodium benzoate given to combat shock. Laboratory findings: RBC-2,700,000; WBC-19,500; Hgb. 56 percent. Two thousand cubic centimeters of fluids and 1 unit of plasma given intravenously. 7 April 1945: Pulse rate elevated with unstable blood pressure. Tracheal toilet performed with good results. Cough reflex has returned as has light accommodation of the eye. Right pupil dilating, left is constricted. Condition very critical. Pneumonia right lung. Laboratory findings: RBC-2,200,000; WBC-11,500; Hgb. 46 percent.

Given 500 cc. whole blood, 1,000 cc. subcutaneous fluids, and 1,000 cc. plasma. 8 April 1945: Blood pressure hovering between 90 to 110 systolic. Laboratory findings: RBC-2,610,000; WBC-15,000; Hgb. 56 percent. Sulfadiazine, grains 5, given intravenously. Penicillin reduced to 20,000 units three times a day. No response to spoken word. Unstable condition. BP-96/70; T-102.6°; P-120; R-36 at 1500. At 1508 patient suddenly went into circulatory collapse and died. Post-mortem x-ray showed all fragments in good condition and alignment. No evidence of depressed bone fragments or foreign bodies anywhere. Post-mortem examination not done aboard ship on advice of commander of vessel. Patient died just before arrival at the first port, Saipan, although worked with constantly, day and night, continually fighting a gradually failing medullary circulatory center and a complicating hypostatic pneumonia added to the pre-existing malaria.

Case 4.—Much of left index finger had been severely avulsed by a gunshot, leaving finger dangling with open metacarpophalangeal joint and very dirty wound. Thoroughly scrubbed with green soap, irrigated well with saline solution, and fresh clean amputation done through distal head of second metacarpal bone, which allowed for clean, viable skin flaps. Skin approximated without tension with interrupted cotton suture and given adequate drainage with through and through sulfa-vaselin gauze drain. Placed hand in splint for healing. No reaction and safe for transportation to hospital ship.

Case 5.—Present injury: Received gunshot wound of right shoulder while in action against organized enemy. The site of entry of the missile was in the posterior aspect of the right shoulder with tissue loss at point of exit anteriorly. The muscles of the brachium were in spasm. The shoulder was drawn up in hunched position. Physical examination: T-98.8; P-100; R-20; BP-110/76. Gunshot wound of right shoulder, missile entering posterior aspect of right shoulder about the level of the neck of the humerus and making its exit through anterior surface right shoulder. Muscle of brachium in spasm with some tissue loss at point of exit of bullet. X-ray examination showed: Compound, comminuted fracture upper quarter of right humerus and head of humerus. Distal fragment at about 70° angle to head of humerus. Treatment: (1) Debridement of wound. Hydrogen-peroxide irrigation of wound. (2) Alignment of fragments with proximal end of distal fragment implanted into the shattered head of humerus under ether anesthesia. (3) Vaseline-gauze pack and body spica aeroplane-type cast applied with right-angle flexion at elbow joint and forearm in full supination. (4) Penicillin 20,000 units at once, then 15,000 units every 3 hours. (5) Tetanus toxoid, 0.5 cc. (6) Antigas gangrene serum. (7) Plasma 500 cc. 3 April 1945: Patient recovered from anesthesia. No complaints. T-99; P-94; R-20. 4 April 1945: T-100; P-106; R-20. Sulfadiazine grains 30 at once, then 15 grains every 4 hours with equal amounts of sodium bicarbonate. 5 April 1945: RBC-3,100,000; WBC-6,900; Hgb. 62 percent; Segs. 78 percent; Lymphs. 22 percent. 6 April 1945: T-99.2; P-80; R-20. Penicillin discontinued, total of 560,000 units given. 7 April 1945: T-99; P-100; R-20. No complaints. 9 April 1945: Transferred to Navy 3245.

Comment: Patient had no injury to the three main nerve trunks even though during surgery the axillary and radial nerves were both lodged between sharp fragments of bone. The tense radial nerve had to be carefully held mesially with one finger when the arm was pulled out, at the same time guiding the main pointed shaft of humerus directly into comminuted head. Patient left ship in good condition, happy and moving fingers well.

Case 6.—Physical examination: T-98.8; P-78; R-20; BP-100/80. Patient has bullet wound through scrotum. Bullet entered low and passed upward laterally

through septum to emerge from large wound. Scrotum swollen markedly. Treatment: Attempts at aspiration unsuccessful. Vaseline gauze placed through and through wound. Blood evacuated from wound. Given penicillin, 20,000 units at once and 5,000 units every 3 hours, and one unit of plasma. 3 April 1945: Indwelling catheter. Sulfadiazine started. 4 April 1945: RBC-2,830,000; WBC-7,750; Hgb. 60 percent; Segs. 76 percent; Lymphs. 17 percent. 7 April 1945: T-98.8; P-80; R-18. Patient not complaining, eating well. Bowels have not been evacuated for 36 hours. To have enema if no bowel movement by 1600 today. Vaseline pack removed and rubber drain inserted through and through wound. 9 April 1945: Transferred to Navy 3245.

Comment: When patient left ship he was free of shock. The large pineapple-sized, bluish-black scrotum had receded in its edema and hemorrhage down to size of orange with penis and bladder free of injury. Interesting pathway of bullet which entered low down in bottom of left scrotum, traveled obliquely upward through septum and out of upper right scrotum. Conservative measures here were ordered and resulted in satisfactory progress.

Case 7.—Present injury: Patient received gunshot wound in right upper arm just above antecubital fossa while in action against organized enemy. The point of entry of the bullet was the medial aspect of the brachium just above the antecubital fossa and point of exit laterally about 7 cm. above elbow. Physical examination: T-99.4; P-78; R-20. Gunshot wound right arm. Point of entry of bullet on medial aspect of distal end of upper arm just above antecubital fossa. Point of exit laterally about 7 cm. above elbow. Some tissue loss at point of exit. Muscle spasm about elbow. Crepitus present with forearm flexed. X-ray examination: Compound, comminuted supra-condylar fracture right humerus. Y-fracture with marked displacement of fragments. Treatment: (1) Tetanus toxoid, 0.5 cc. (2) 10 cc. gas gangrene serum. (3) Plasma, 1,000 cc. (4) Debridement of wound, hydrogen peroxide irrigation. Reduction of fracture, vaselin and sulfanilamide pack in wound. Body spica applied, aeroplane type with arm in right-angle flexion at elbow joint and forearm in full supination with radial-ulnar pin for traction, ether anaesthesia. (5) Penicillin, 20,000 units at once, then 15,000 units every 3 hours. 3 April 1945: T-98.6; P-80; R-20. Condition satisfactory, allowed to sit up 30 minutes. Sulfadiazine, grains 30 at once, then grains 15 every 4 hours with equal amounts of sodium bicarbonate. 4 April 1945: T-99.4; P-100; R-20. No complaints. 6 April 1945: Penicillin discontinued, total of 560,000 units given. Given 1,000 cc. 5-percent dextrose in physiologic saline solution intravenously. 7 April 1945: T-99.2; P-100; R-20. No complaints. 9 April 1945: Transferred to Navy 3245.

Comment: Even though unusually severe soft tissue damage at elbow joint, the circulation remained viable to fingers, and all three main nerve trunks continued to function without evidence of injury or pressure. Patient left ship at Saipan laughing and moving his fingers freely. This man was buddy to the brain case (Case 3), and remained with him all through the night in the foxhole. He expected to lose his right arm when he came aboard.

Case 8.—2 April 1945: RA & C. Diagnosis changed to compound-compression fracture of the fifth lumbar vertebra by reason of establishment. Present injury: About 12 hours previously patient was shot in the back in action against organized enemy. He lay in a shallow stream, unable to move for about 8 hours after which he was evacuated to this ship. On the beach he received 2 units of plasma and 0.5 grain of morphine. He complains of having no sensation in feet and paralysis of feet. Physical examination: T-98; R-20; P-120; BP-80/60. Small entry wound in left lower lumbar region. On the abdomen about four fingers' breadth above anterior superior spine there is a superficial wound of left abdominal wall.

Neurological examination at this time showed absent knee and ankle jerks, loss of sensation in perineum, posterior aspect of thighs, and lateral aspect of feet. Position sense was lost in feet. He also had urinary retention and rectal examination revealed bright red blood in stool. He was in severe shock. Course: He was immediately given morphine, 0.5 grain and blood plasma was begun. Over 8-hour period he received 1,000 cc. plasma, 500 cc. blood, and 3,000 cc. physiologic saline solution. He made a good recovery from shock and the following day, due to progressive increase in local rigidity lower left belly, an exploratory laparotomy was performed but no perforations were found. Massive hemorrhage in abdominal wall and pelvis with numerous local regions of large bowel injury with petechial hemorrhage in bowel wall but no evidence of gas or through perforation. No reaction to belly exploration. On 7 April 1945 a body cast was applied with back in hyperextension. 8 April 1945: Position sense was markedly improved and the anesthesia of the lateral aspect of the feet had given way to perception of dull sensation. No motion of feet regained. 9 April 1945: Transferred to Navy 3245.

Comment: Left ship in body cast, happy, free of pain and shock. Of interest here was the fact that the patient stated he was sure he had been shot twice, and the odd course of the bullet which traversed through left ilium, cut across to opposite side of abdomen, ricocheted off opposite ilium back into spine, and produced compression fractures fifth lumbar vertebra and paralysis of both feet. It is believed that there is large hematoma here and not cord injury.

GENERAL DISCUSSION

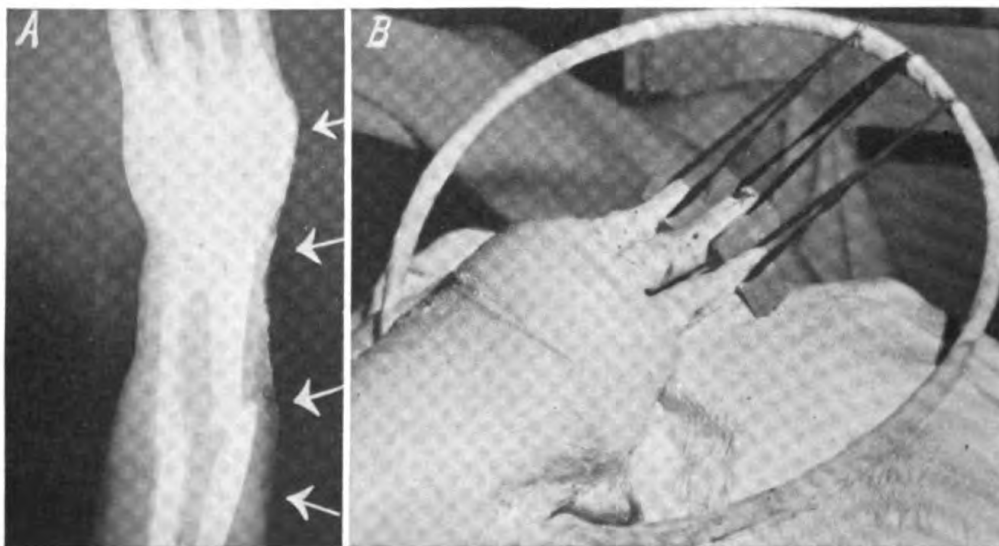
During a 5-year period of very heavy construction, working part time as surgeon for America's third largest city water and power bureau, the writer experienced all of the trials and complications which are so frequent when dealing with severe injuries in an age group of the fourth, fifth, and even sixth decades of life. Here one was ever on the alert for poor healing, delayed bone union, the low resistance of patients to complicating infections and a woeful lack of cooperation on the part of patient to obtain a good result. Altogether too many former W. P. A. men at this particular period of "compensation conscious industry," were shockingly happy to be partially crippled either honestly or as a malingerer, and thus obtain a permanent rating of disability.

It was both surprising and gratifying to the writer to see so many of our fine young American boys come aboard ship with such ugly, crushing, explosive type wounds, in profound shock, but still able to give that good old "American grin" and remark "Hell, I only got one Jap!" One teen-aged boy with a bloody, torn scalp was actually laughing and to all appearances the head injury meant nothing in his young life, compared with the huge Japanese saber which he had pulled out of the hands of his assailant after first "getting his man." Such incidents are too numerous to mention.

All extremity compound fractures were first tested for nerve injury and then for viable circulation before final judgment was rendered as to type of surgery to be done. The same type of crushing, avulsion of

bone, and joint injury to that older man in industry would have warranted clean amputation during that 8 to 10 hour "safe period" and certainly before gas gangrene set in and extended beyond any site for elective work.

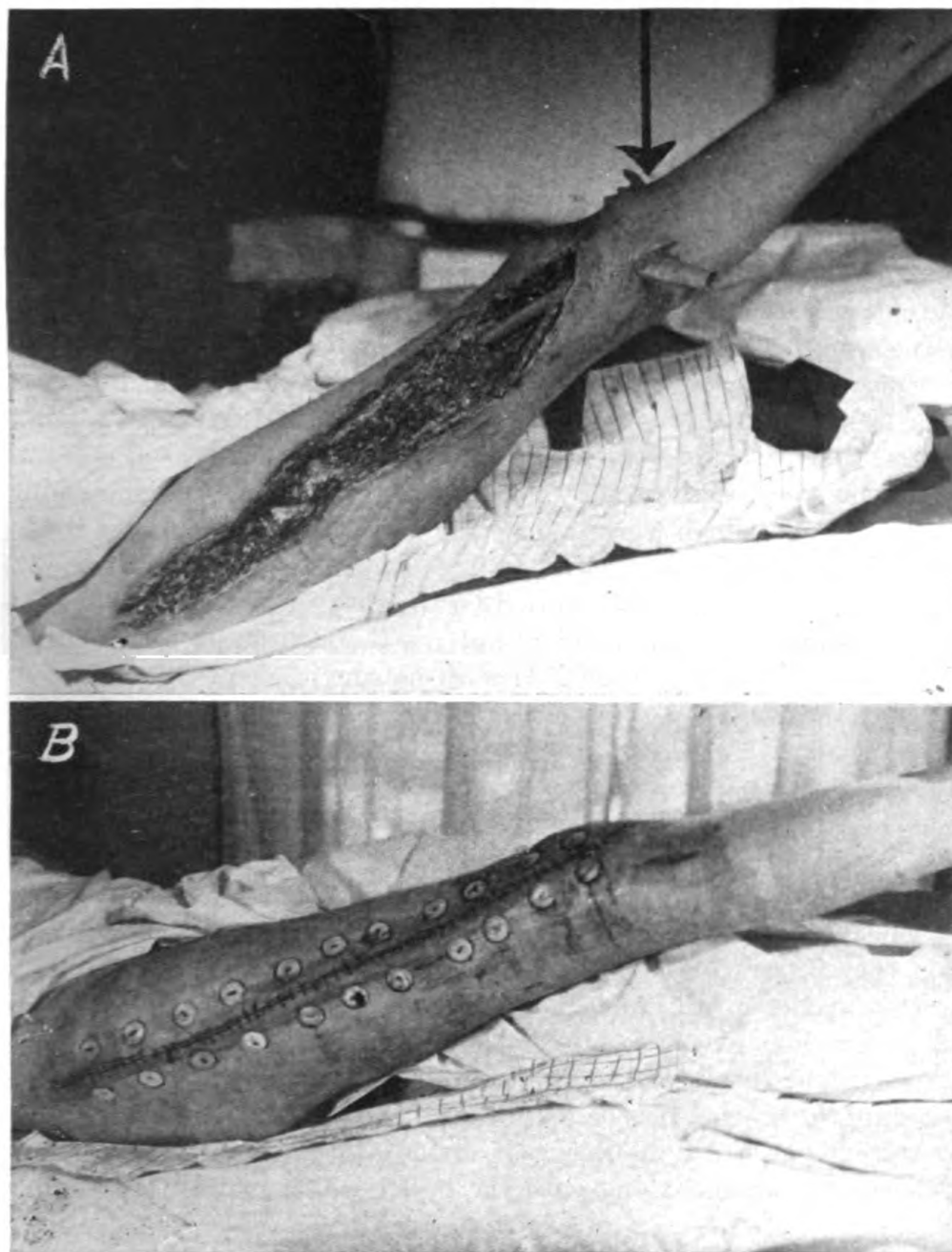
All severe compound fractures immediately received combined gas-tetanus sera, 20,000 units of penicillin with a similar dose every 4 hours, blood plasma, and whole blood during and after thorough but conservative surgery. The writer has never before seen such extensive loss in soft tissue, with comminution of bone, respond so rapidly to treatment and without complication. Not one case required amputation of a major extremity! In the humble opinion of the author the answer to this riddle is a combination of God's will, vigorous youth, and the prompt, early use of penicillin, blood, and plasma in quantity.



2. (A) Compound fractures of forearm with extensive soft tissue loss and amputation of thumb. (B) Author's method of fracture reduction using traction banjo splint incorporated in plaster cast. Usually with double fractures of forearm with loss of the splinting ulna, the author, when performing elective surgery, would vitallium-plate the ulna, especially in mid one-third fractures.

It is believed that gas serum is not nearly as important as large repeated doses of penicillin in the preventive treatment of gas gangrene.

When dealing with compound fractures it is advisable, when possible, to "set the fracture." Often one can place the pointed end of one bone directly into the medullary cavity of the other bone. It may be necessary to maintain position and bone alignment with traction pins incorporated into the plaster cast. Even though one is invariably in great haste and assuredly working under the handicap of the tension present during the attack, it is well to leave the traction pin application until last. Finish up the cast and then place the pins



3. (A) Case of a 24-inch laceration of thigh with infection. Through and through Penrose drains at knee joint. This wound responded quickly to irrigation and sulfa crystal dusting. (B) Author's method of wound suture, with quick recovery, complete functional result, and no permanent disability. Following three negative wound cultures the wound was approximated with interrupted non-absorbable silk sutures tied over buttons for retention. This overcomes all small stitch tension and at the same time prevents dead space hemorrhage with its attendant infection.

in an aseptic manner, after which traction is maintained carefully while more figure-of-eight plaster rolls are placed around the pins and incorporated into the rest of cast.

It is positively amazing how much extensive bone fragmentation and soft tissue destruction is found inside the extremity even though there is only a small entrance wound. Often the bullet spreads inside the extremity and thus the exit wound is wide open and lacerated, with invariably so much more bone fragmentation at the exit than at the entrance wound of bullet.

Incoming casualties were all brought on board in landing boats. Serious convalescent post-operative patients were transported to a base hospital when their condition had improved to an evacuable status. All patients, some in various forms of plaster casts, body or aeroplane spica, were transferred off ship in a Stokes stretcher using our hand davit which worked smoothly and with a minimum of interference with the ship's activity.

During the invasion procedure we used ether, local novocaine, intravenous sodium pentothal, and spinal anesthetics usually alone but at times in combination. Our choice of anesthetic agent depended entirely on the condition of patient and especially on the type of surgery to be performed. We had no reaction of any kind to blood plasma or whole blood transfusions. One slight reaction developed during intravenous saline and this was thought to be due to the rubber tubing.

We were happy to be able to supply the beach and an LST-H with 100 flasks of plasma, 4,000 sterile dressings, and some whole blood.

None of our cases developed gas gangrene. Here permit me to mention that 2 days previous to "invasion day" the writer made up a written memo to "all hands" and submitted this to our commanding officer for distribution to all combat personnel to be sure and take a soap scrub bath followed by change to clean clothing the night before invading the beach. It is believed that this is an important preventive measure in gas infections because it obviates forcing of skin or clothing dirt into the wound along with the bullet which in itself is usually sterile.

In conclusion the writer would like to note that we left the United States a very green medical department, but the concentration of such serious and varied pathology which came aboard during the invasion produced within days practically a veteran crew. It is with great pride that the writer considers the hard work, the constant nursing care of the hospital corpsmen and the ever-vigilant attention of the doctors in their never-ceasing efforts to keep serious patients alive during a rough sea voyage from the target out to an island base hospital.

DEFINITIVE SURGICAL TREATMENT OF WOUNDS OF THE COLON AND RECTUM

G. ARNOLD STEVENS

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and

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Patients arriving at this naval hospital who have survived war wounds of the small intestine, colon, or rectum are a living tribute to emergency treatment overseas. The lives of these patients were saved by surgery accomplished under difficult conditions in the field.

It is apparent that two general principles were followed in the initial surgical care of such cases. With wounds of the small bowel primary restoration of intestinal continuity was made by closure of perforations, or resection and anastomosis. With injuries of the large bowel the principle of exteriorization was used, or some type of colostomy was performed. Results indicate that these methods are sound.

The definitive treatment of these patients becomes the obligation of continental naval hospitals. Rational selection of surgical procedures has been difficult with some cases because the exigencies of combat conditions precluded detailed entries in the health records or because records were destroyed in action or became separated from the patients' effects. Obviously, both the choosing and execution of a surgical procedure are important; however, adequate preoperative preparation and meticulous attention to postoperative care are essential if minimum morbidity and mortality are to result.

The four cases reported in this paper illustrate the types of problems usually involved with patients who have received emergency treatment for wounds involving the large intestines and rectum.

CASE REPORTS

Case 1.—An 18-year-old private, U. S. M. C. R., stated that he was admitted to the sick list 16 April 1945, in the field, with the diagnosis "wound, gunshot, abdomen." On 17 April, he was operated and a "colostomy" was made. Information to this effect was not in the health record, but was obtained verbally from the patient.

On 20 June 1945 the patient was admitted to this naval hospital. He was malnourished owing to loss of secretions through what appeared to be a double-barreled ileostomy or ileocolostomy. The skin around the stoma was markedly excoriated. A roentgenogram of the colon suggested obstruction of the distal transverse colon. By the nature and amount of drainage, it was obvious that the ileum was patent. The excoriated skin healed following continuous application of Lassar's paste, after which definitive surgery was undertaken.

Since, in view of the roentgenographic finding, it was considered unwise to apply spur clamps in anticipation of closing the stoma, the abdomen was opened for exploration. It was apparent that an exteriorization type of ileocolostomy had been made which included the right half of the colon and the terminal portion of the ileum. The proximal part of the remaining transverse colon was constricted by a mass of adhesions, including omentum. This portion of the colon and a section of the ileum were resected. Intestinal continuity was established by a one-stage, end-to-side, ileo-transverse colostomy. The abdomen was closed without drainage. During the operation 500 cc. of citrated whole blood was given as prophylaxis against shock.

Penicillin, 30,000 units every 3 hours, and sulfadiazine, 1 gram every 4 hours, were given for 5 days following surgery. Convalescence was uneventful and the patient was up and walking on his eighth postoperative day. He gained weight rapidly, despite three to six stools daily. The frequent stools obviously were a result of the reduction in the concentrating ability of the colon owing to removal of the long segment. He was surveyed from the service for this reason, although generally he appeared to be in excellent condition.

Case 2.—A 36-year-old chief gunner's mate was admitted to the sick list in the field, 17 March 1945 with the diagnosis "wound fragment, abdomen." The small bowel was perforated and protruded from the abdomen. There was also a large hole in the cecum. One portion of the ileum was resected and end-to-end anastomosis was made. The small perforations were closed with purse-string sutures. The cecum was treated by bringing it out of the wound and suturing it to the skin.

The patient was admitted to the hospital 3 June 1945 with a cecostomy and a fistula in the lower end of the right rectus wound. After adequate preparation, surgical closure of the cecostomy was made. The fistula extended to the edge of the ileum. The tract was resected and sequestrectomy was performed. For 5 days postoperatively, penicillin, 30,000 units every 3 hours, and sulfadiazine, 1 gram every 4 hours, were administered. The wound healed primarily. The patient was ambulatory after the eighth postoperative day and was subsequently returned to duty.

Case 3.—A 29-year-old private, U. S. M. C. R., stated that he was wounded in the abdomen on 23 February 1945. He stated that a transverse colostomy was made in the field because of a wound of his large bowel. No information was given in the health record. He was evacuated by ship and eventually admitted to the hospital on 10 June 1945. Examination revealed what appeared to be a temporary transverse colostomy with a sinus in the scar. A fistula was draining from a lower left rectus postoperative scar. The patient was prepared and the first stage of definitive procedure was carried out on 10 July 1945. A Y fistula extending to the sigmoid and to the ramus of the pubis was resected. Sequestrectomy of the ramus of the pubis was performed and the sigmoid colon, which was involved, was resected. Bowel continuity was reestablished by an end-to-end anastomosis. During the operation 500 cc. of whole blood was given as prophylaxis against shock. The wound healed primarily and the patient was am-

bulatory on the eight postoperative day. On 23 July 1945 after roentgen studies with a barium enema showed the sigmoid anastomosis to be intact, spur clamps were applied to the colostomy. The spur was destroyed and the colostomy was closed on 15 August 1945. The sinus tract in this wound was traced to a silk suture. The wound healed primarily and the patient was ambulatory on the eighth postoperative day. Combined penicillin and sulfa therapy was included in the postoperative care for 5 days after each operative procedure. This patient will be returned to duty.

Case 4.—A 20-year old seaman, first class, entered the sick list aboard ship with the diagnosis "wound fragment, shell, rectum," on 6 April 1945. There were two large, gaping wounds of the buttocks and rectum. (The patient also had a compound fracture of the left ankle.) Treatment had consisted of loop colostomy (sigmoid) and debridement, with subsequent packing of the posterior wounds.

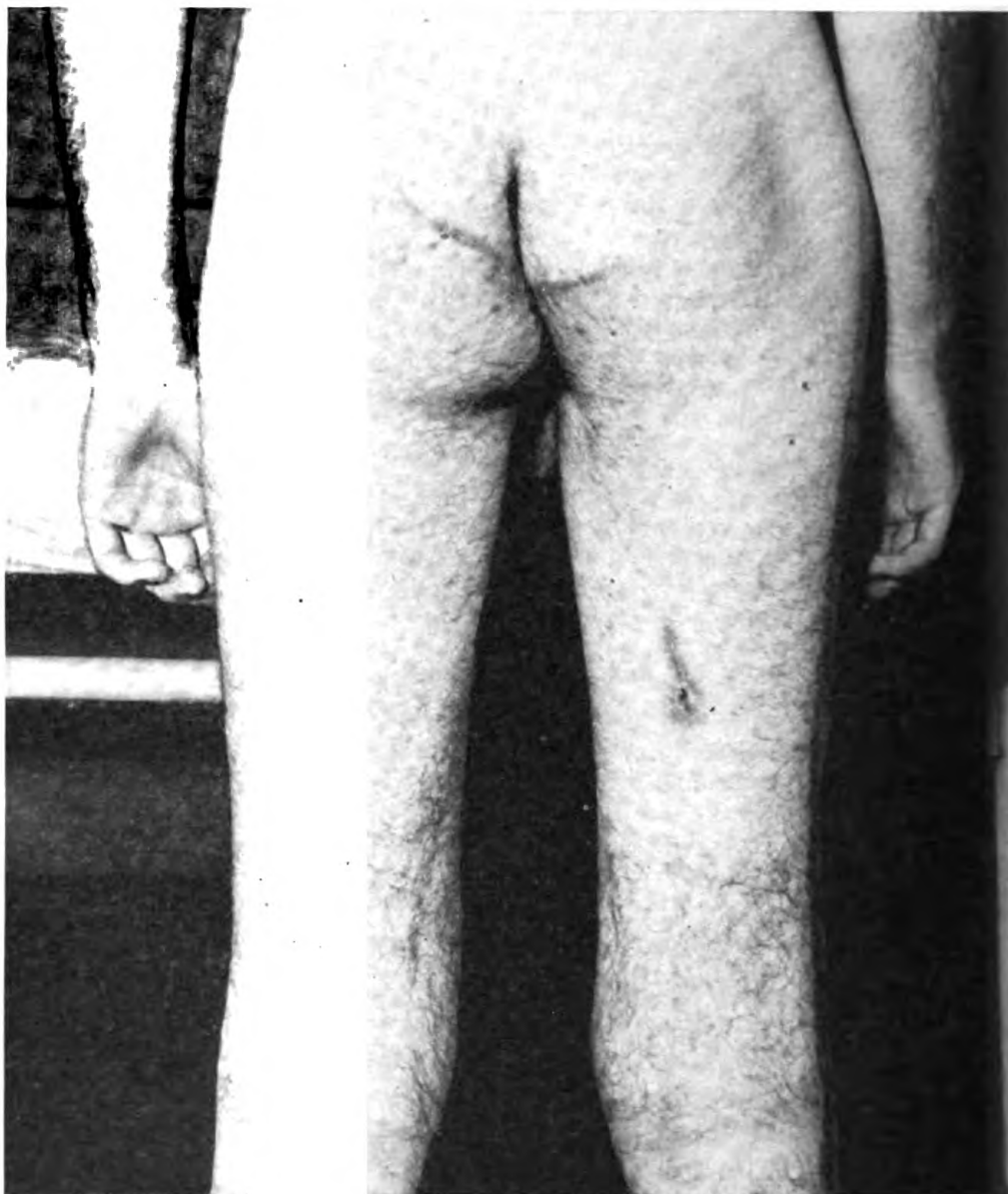
The patient was admitted to the hospital on 23 June 1945. The cavities at that time consisted of huge, painful, depressed scars extending to and partially obstructing the rectum. A radical excision of all scar tissue was made on 1 July 1945. By extensive undermining, mobilization, and fashioning of skin flaps, a satisfactory plastic result was obtained. (See photograph.) Following the surgery, 30,000 units of penicillin every 3 hours were given for 7 days. The wound healed by first intention. Sphincter control was normal to digital palpation.

On 16 July 1945 colostomy spur clamps were applied. The spur was destroyed and closure of the colostomy was made on 4 August 1945. The patient received penicillin and sulfadiazine for 5 days postoperatively. The wound healed primarily. Sphincter control remained intact with normal bowel movements. The patient will be returned to duty.

COMMENT

The four cases reported cover the various areas of the large bowel from the ileocecal region to the rectum. They illustrate the usual types of injuries to the colon seen at this hospital during the past 6 months. For two of the cases there were no data in the health records describing findings and treatment on original admission to the sick list. The emergency procedures were carried out under difficult conditions in the field; however, insofar as possible, records of pertinent information about such treatment obviously will facilitate the definitive care of these patients.

The absence of mortality and negligible morbidity in cases such as the four reported at this hospital, we believe is attributable to several factors aside from, and possibly more important than, surgical technique. Probably the most important single factor is a "clean" bowel. This can be accomplished adequately by irrigations and nonresidue diet, in contradistinction to a low-residue diet. This point cannot be over-emphasized. We have discontinued the use of intraperitoneal vaccines and sulfa drugs preoperatively, since these adjuncts have not produced improved results in our hands. Recent reports on the use of succinylsulfathiazole are favorable but we have not used the drug.



(Case 4.) Postoperative result following plastic reconstruction of buttocks and rectum. Sphincter control is normal.

In every resection of the colon we routinely give a transfusion of 500 cc. of whole blood during the operation, for the purpose of preventing rather than treating shock.

In our recent experience, closure of colostomies has been uniformly successful, for which we credit several factors. The bowel must be "clean" at the time of operation and for several days after surgery. *The spur must be completely obliterated*, which often requires more than one application of spur clamps. Excision of the scar and other adventitial tissue should be radical, so that clean viable tissue remains. Approximation must be without undue tension. This is particularly

true of the fascia which is closed over the bowel. A small drain is placed in the fat, down to the fascia but not through it. The drain is removed within 24 to 48 hours. Fecal fistula not infrequently develops if the drain is placed to the suture line of the bowel. The skin should be accurately approximated and kept dry. Our cases receive light treatments for 30 minutes twice daily to help accomplish this.

In our experience these wounds have healed after using fine chromic catgut equally as well as with wire. A minimal amount is used of a caliber never larger than 0. Bleeders are tied with 000 or 0000 chromic catgut. Formerly, when we used more and larger sizes of chromic and plain catgut, the frequency and amount of drainage was a nuisance. Apparently too many sutures strangulated the tissue and produced serum. The larger sutures constituted an unnecessary amount of foreign body in the wounds. Plain catgut, of any size, causes more reaction than chromic catgut so we do not use it. We believe that silk and cotton sutures in potentially infected wounds of this type are to be condemned. In case 3, one sinus tract was traced to a silk ligature. This was not an isolated case.

This method of treatment constitutes detailed application of simple fundamental principles and meticulous postoperative care. There is no effective substitute in surgery of the large intestine.

The combined use of pencillin and sulfa drugs, we believe, merits consideration. Our results from the use of either of these agents alone has not been remarkable.

GENERAL OUTLINE OF TREATMENT

The following plan is used at this hospital in the preoperative and postoperative treatment of colon cases requiring surgery. It is, of course, modified as indicated by the requirements of each case.

PREOPERATIVE ORDERS

1. Patient may be up and about as desired.
2. Rectal irrigations or irrigation of the proximal and distal loop as indicated, twice daily, with physiologic saline solution or water.
3. Syphon contents if necessary to empty bowel.
4. Fleets' phosphate-soda, 2 teaspoonfuls three times daily.
5. Irrigate the bowel on the morning of surgery and syphon off the contents. Then give 1 teaspoonful of paregoric, by mouth.
6. Vitamins: Ascorbic acid, 100 mg. intramuscularly, daily; thiamine hydrochloride, 25 mg. intramuscularly, daily.
7. Amigen if hypoproteinemia exists.
8. Nonresidue diet, as outlined, for 4 days before surgery.

*Nonresidue Diet**Breakfast*

Fruit juice (any kind), 1 glass.
Heavy cream, 4 tablespoonfuls.
Egg, 1.
Butter, 1 patty.
Arrowroot cookies, 2.
Coffee.

0900

Candy (either pure-sugar candy or milk chocolate without nuts), 5 ounces.

Dinner

Broth with 1 patty of butter.
Gelatin, plain, 2 heaping tablespoonfuls.
Cream, 40 percent, 4 tablespoonfuls.
Fruit juice (any kind), 1 glass.
Tea or coffee.

1500

Fruit juice (any kind), 1 glass.

Supper

Broth with 1 patty of butter.
Steamed rice, 2 heaping tablespoonfuls.
Cream, 40 percent, 4 tablespoonfuls.
Fruit juice (any kind), 1 glass.
Tea or coffee.

NOTES.—1. Sugar as desired for tea, coffee, and rice. 2. We have discontinued larger doses of vitamins. It has seemed unnecessary. Thiamine hydrochloride in large doses causes emesis in some cases.

POSTOPERATIVE CARE

1. Water, 1 ounce every hour is permitted the first day. This improves the patient's morale and does no harm. The fasting stomach receives 1 to 2 quarts of secretions daily. Obviously, the addition of such a small amount of water is inconsequential.

2. Two ounces of water every hour may be given the second day.

3. Intravenous fluids are administered as indicated.

4. Chewing gum and sucking an orange or lemon slice are enforced. This seems to prevent postoperative parotitis, which is too often a postoperative complication.

5. A rectal tube is used as needed to reduce distention. If left in for more than 1 hour at a time the anus becomes sore and the tube often becomes plugged.

6. Morphine or a similar narcotic is given as needed.

7. To minimize the incidence of vascular and pulmonary complications the following procedures are routine:

(a) Deep-breathing exercises every hour.

(b) Bicycle exercises of legs.

(c) Frequent turning of patient and backrub.

(d) Providing there are no contraindications, the patient sits up on the seventh postoperative day and walks on the eighth postoperative day.

NOTE.—The rehabilitation department has cooperated most efficiently with this program.

8. Starting the third postoperative day, food is given as follows:

From third postoperative day to fifth postoperative day:

Wholly Residue-Free Diet

Breakfast

Fruit juice (any kind), 1 glass.
Egg, 1.
Butter, 1 patty.
Cream, 4 tablespoonfuls.
Coffee.

Dinner

Broth.
Jello, plain, 2 heaping tablespoonfuls.
Butter, 1 patty.
Fruit juice, 1 glass.
Cream, 40 percent, 4 tablespoonfuls.
Tea or coffee.

Supper

Broth.
Rice, steamed, 2 heaping tablespoonfuls.
Butter, 1 patty.
Fruit juice, 1 glass.
Cream, 40 percent, 4 tablespoonfuls.
Tea or coffee.

Diet after fifth postoperative day:

Low-Residue Diet

Breakfast

Orange juice.
Bland cereal.
Cream.
Bacon or egg.
Toast and butter.
Coffee.

Dinner

Meat soup (strained).
Meat.
Potato, rice, or macaroni.
Vegetable puree.
Bland dessert (no fruit).
Bread and butter.
Jelly if desired.
Tea.

Supper

Meat or fish.
Potato, rice, or macaroni.
Bland dessert (no fruit).
Bread and butter.
Jelly if desired.
Tea.

From eighth postoperative day to twelfth postoperative day:

Modified Low-Residue Diet

To the low-residue diet are added the following foods:

Milk, bland fruits, and whole low-residue vegetables.

When an increased food intake is desired, more of the foods listed in the **Low-Residue Diet** may be given (except egg and cream), and the following may be added: Pure sugar candy, arrowroot cookies, and broiled steak. **Vegetables** allowed: Puree of peas, string beans, asparagus, lima beans, sweet corn, and carrots.

The diets listed are supplemented with vitamin B₁ (25 mg.) and vitamin C (100 mg.) daily.

SUMMARY AND CONCLUSIONS

1. An effort has been made to review usual problems involved in the definitive treatment of wounds of the large intestine.
2. Four cases have been reported which illustrate the types encountered.
3. A general plan of treatment has been presented. Its use has effected satisfactory rehabilitation of these patients. It has been accomplished with minimum morbidity and no mortality.



DICUMAROL THERAPY IN ACUTE CORONARY THROMBOSIS

Dicumarol was given to 44 unselected private patients in 50 attacks of acute coronary thrombosis during the last 2½ years, with an immediate mortality rate of 16 percent.

All of the 26 patients who were treated in their first attack survived.

No mural thrombi nor systemic or pulmonic embolic phenomena were found in six autopsied cases. Only in one case was there clinical evidence of pulmonary embolism, and the patient in this case received an ineffective dose of dicumarol.

Much of the literature relative to embolic complications and the immediate mortality rate in acute coronary thrombosis, and some papers on the clinical use of dicumarol are summarized.

Dicumarol, a safe drug if used intelligently, probably decreases the immediate mortality rate in acute coronary thrombosis. It appears nearly always to prevent pulmonary and systemic vascular embolization and thrombosis if used in adequate amount.—NICHOL, E. S. and PAGE, S. W., JR. (Miami): Dicumarol therapy in acute coronary thrombosis; results in 50 attacks; with review of data on embolic complications and immediate mortality in myocardial infarction. *J. Florida M. A.* 32: 365-370, January 1946.

PRESONDYLOLISTHESIS¹

A Study of Twenty-three Cases

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and

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Prespondylolisthesis is not too uncommon and as it may be overlooked as well as cause disabling low back pain this clinical study is presented. Twenty-three such cases were seen and studied in a group of 350 consecutive cases of low back pain during a period of 7 months. This is an incidence of 6½ percent. In the same group were six cases of spondylolisthesis, thus indicating a greater frequency of almost 4 to 1 of the so-called "pre-slipping stage" compared to the stage of actual slipping. All cases were males in the military service.

Ages of the patients, who were all white except for one negro, with prespondylolisthesis ranged from 19 to 51 with an average age of 30. Nine of these dated the onset of symptoms from a recalled injury such as a fall, strain, or auto accident while the others stated the back pain developed gradually without a primary injury. Few alleged that they had always had a weak low back. Symptoms had existed prior to being seen by us for from 1 month to many years with an average duration of 3½ years. Nearly all had had previous physical and radiographic examinations and only 3 of the 23 had been diagnosed as prespondylolisthesis. Various diagnoses had been made, such as myositis, strain, sprain, and arthritis, while some were described as having a considerable "functional overlay" and no apparent organic pathology.

The diagnosis of prespondylolisthesis was made from the history, physical, and radiographic examinations.

Pain in the low back was present in all the cases. This was not constant but intermittent in nature being brought on by strenuous physical activity such as bending, lifting, and riding over rough surfaces. Most of the patients, however, complained of constant dull aching and some described a feeling of weakness in the low back. Approximately one-half of the patients had some radiation of pain

¹ From the orthopedic department of a United States naval base hospital in the South Pacific.

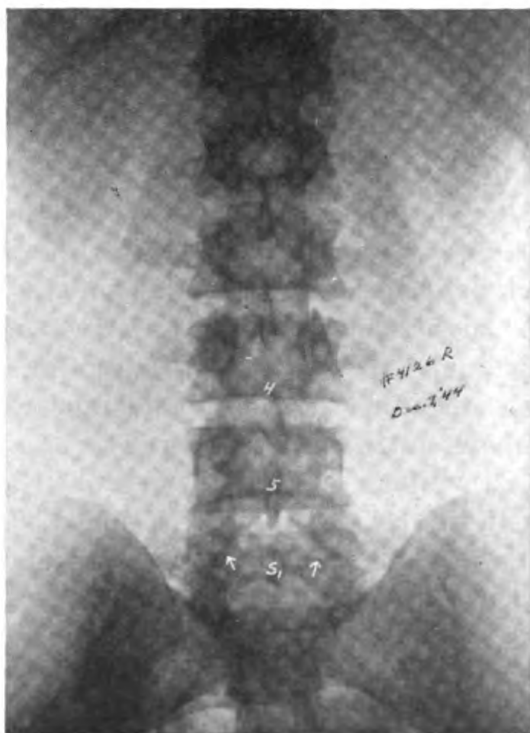
with a sciatic distribution into one or both legs during attacks of acute low back pain.

Physical examination revealed moderate to fairly marked lumbar muscle spasm and corresponding limited spinal motions, especially flexion and extension in all except five cases. Tenderness to percussion at the lumbo-sacral area was present in all. There were no apparent spinal deformities, although some had an increased sway back. Leg findings were negligible except straight leg raising which

was as a rule moderately limited bilaterally. There were no demonstrable reflex or sensory changes and no muscle atrophy of the legs.

The conclusive evidence for establishing the diagnosis of prespondylolisthesis was by radiographic examination with the demonstration of a defect in the neural arch between the superior and inferior articular processes. In suspected cases multiple views were taken in various planes; antero-posterior, lateral, and right and left oblique.

The fifth lumbar was alone involved in 12 cases; the fourth in 2; a lumbarized first sacral segment in 7 (figs. 1 and 2); and a combination of the fourth and fifth lumbar in 2 (figs. 3 and 4). All of the



1. Lumbarization of first sacral segment (S_1) with suggestive defects of the neural arch (arrows). See figure 2.

cases revealed bilateral defects of the arches except 6 in which only a unilateral defect was demonstrable.

No definitive treatment, such as external support or spinal fusion was given any of the patients. It was felt that those requiring such treatment were not fit for overseas military duty and should be evacuated to the United States for either reassignment or discharge. Those patients who had relatively minor complaints and findings, and if their military duties were not too strenuous, were sent back to duty after a period of rest, physiotherapeutic measures, and correction for any postural imbalance. Eighteen of the patients were evacuated to the United States and five were returned to duty.

One of the patients showed some lower lumbar hypertrophic arthritic

2. Same case as figure 1. This is a 15° angle projection of rays from below upwards. Defects of this lumbarized first sacral segment well shown (arrows). Lateral and oblique views showed the defects much less plainly. The patient, 21 years old, had "always" had a "weak" lower back as had his father and grandfather. He had a dull low backache with some muscle spasm and localized spinal tenderness at this area. Improvement occurred with rest and he was returned to duty which was not strenuous.



changes which were considered sufficient to account for his low back pain.

None of the 23 patients showed any definite evidence of a herniation of nucleus pulposus, such as a narrowed disk by radiograph, or lower-extremity motor, reflex, or sensory change.

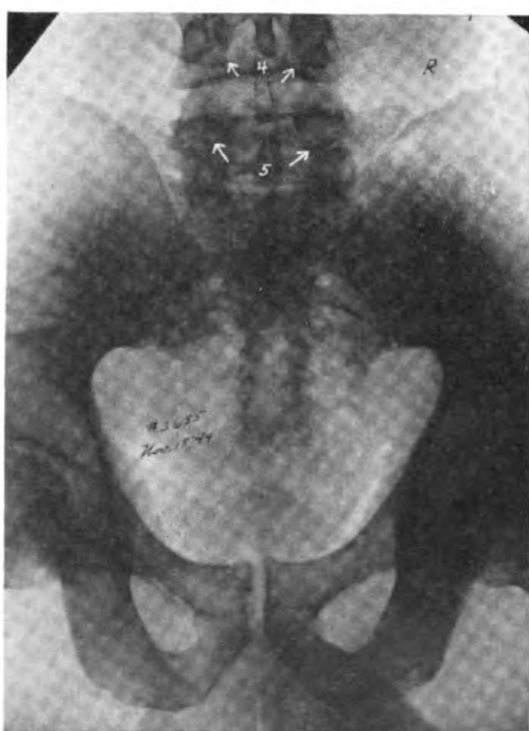
DISCUSSION

A defect of the neural arch may be unilateral or bilateral and occurs between the superior and inferior articular processes. Opinion is divided as to the cause. Some writers believe that trauma during birth may cause either fracture or "infarct" of the isthmic region with subsequent incomplete repair giving rise to the defect which simulates a pseudo-arthritis. Others are of the opinion that the defect represents a failure of bony fusion of two separate centers of ossification for a half of the neural arch.

A typical vertebra, according to Cunningham's Textbook of Anatomy, is ossified from three primary centers and five secondary centers. The three primary centers are one in the body and one in each half of the vertebral arch (neural arch); the five secondary centers appear at the tip of the spine, the tips of the transverse processes, and the upper and lower surfaces of the body. The primary centers for the arch appear at the roots of the articular processes; the arch and its processes are ossified from them, also the postero-lateral parts of the

body. In discussing variations from the foregoing it is further stated that the fifth lumbar may have two primary centers in each half of the arch; the two parts of each half are then united by a plate of cartilage set obliquely between the superior and inferior articular processes.

Although the writers have neither embryological nor anatomical proof it is their opinion that the most likely cause of the defect in a neural arch is a failure of bony fusion of two primary centers of ossification for each half of the arch. If such then is the explanation for a defect occurring in the fifth lumbar, namely, failure of bony fusion of two centers of ossification for each half of its arch, which latter variation for the fifth does occur according to Cunningham,²



3. Bilateral defects (arrows) in neural arch of the fifth lumbar (5) and less definite of the fourth (4). See figure 4.

it is likewise felt that this explanation holds for the presence of a defect of the arch of the fourth lumbar as well as of a lumbarized first sacral segment.

Lacking solid bony support as in prespondylolisthesis, muscles and ligaments of the low back likely are subjected to an additional supportive load and hence are liable to earlier fatigue with aching and are most susceptible to injury with consequent pain. Thus it is assumed that patients with a defect of a neural arch have a potentially weak lower back, although not all necessarily develop symptoms. No radiographic study was made to determine the incidence of prespondylolisthesis

in patients without low back pain but the percentage of occurrence is likely higher than commonly believed. In the absence of either strenuous physical activity or injury many of these patients may go through life without any disabling symptoms and the condition be discovered only incidentally, if at all. Two such cases were observed during this study but are not included in this group of cases of symptomatic prespondylolisthesis.

² CUNNINGHAM, D. J.: Textbook of Anatomy. 7th edition, by Brash, J. C. and Jamieson, E. B. Oxford University Press, New York, 1937. p. 119.

No forward displacement in a case of prespondylolisthesis has been observed by the writers although it is felt that such with adequate and long follow-up could be demonstrated at least in some cases. Factors likely to influence this would be increasing age with progressive decrease of muscle and ligament tone, repeated low back strain and injury, sagittally placed intervertebral facets and an increased lumbo-sacral angle as with pronounced sway back.

Suggestive diagnostic signs are a feeling of weakness and a dull ache in the low back with recurrent attacks of acute pain. The latter may be associated with radiation of pain into one or both legs. Tenderness to percussion at the lumbo-sacral area is present. Lumbar muscle spasm with some limited lumbar spinal motion is common. Motor, reflex, and sensory changes of the lower extremities are rare or absent.

Radiographic examination is the only certain diagnostic proof of prespondylolisthesis. In the absence of forward displacement and unless the central rays penetrate directly through the plane of the defect, diagnosis is apt to be overlooked. Hence in suspicious cases careful study of the neural arch for a defect of the pars interarticularis should be made in several views, namely antero-posterior, lateral and right and left oblique.

Treatment of prespondylolisthesis depends upon the severity of symptoms and physical activity of the patient. Those cases having mild symptoms with only moderate findings can as a rule be treated conservatively by correction of any tendency toward overweight and increased lordosis, also symptomatic relief of aching with local physiotherapeutic measures and hard bed.

The patients with more disabling symptoms and findings require in addition to the foregoing, rest and elimination of any strenuous physical activity. If no relief is obtained thereby and the patient



4. Lateral view of same case as figure 3. Defects (arrows) of fourth lumbar (4) and less definite of fifth (5). The patient, 40 years old, had had low back symptoms for 7 years, with findings of lumbar muscle spasm, limited spinal motions and lower lumbar spinal tenderness. He was evacuated.

either prefers or is forced to continue on with a very active physical existence either an external support or spinal fusion is indicated. Patients in the latter group are not considered fit for strenuous military duty and should be either reassigned in some less active duty or be discharged from the service.

SUMMARY

Twenty-three cases of symptomatic prespondylolisthesis that were seen and studied in a group of 350 consecutive cases of low back pain during a period of 7 months are reported and discussed.



SUMMARY OF RECENT REPORTS BY NAVY EPIDEMIOLOGICAL UNIT NO. 50

Comdr. Julius M. Amberson (MC) U. S. N. R., in charge of Navy Epidemiological Unit No. 50, and recent recipient of the Distinguished Service Medal of the United States Navy for his work in the therapy of cholera, has submitted three reports of wartime observations made by his unit while in India and Egypt.

Cholera therapy in India.—In a controlled experiment, Amberson reports that sulfadiazine plus blood plasma administered to support the collapsed patient, was found to be dramatically lifesaving in the treatment of cholera. The case fatality rate by this procedure was lowered from 40–70 percent to zero.

Typhus in Egypt during World War II.—There was an epidemic of louse-borne typhus in Egypt which began in 1939, reached peak in 1943 with 40,084 recorded cases, and began declining in 1944 and 1945. There were 118,851 recorded cases from 1939 to the beginning of 1945. The case fatality rate ran consistently around 19 percent despite any therapy that was applied. The chief success lay in the field of control of the louse, using DDT in 10-percent mixture with talc.

*Schistosomiasis and its control in Egypt.*¹—This disease which has been present in Egypt since ancient times exists there because of infestation with *S. hematobium*, and *S. mansoni*. Approximately one-half the population of Egypt is affected. Great efforts toward the control of the snail host are presently in progress in Egypt, and an extensive program is underway for the treatment of the human host. Much research is being carried out by Egyptian health authorities to discover new molluscicides as well as to improve on the methods of treatment of the infected population.

¹ See p. 977 of this issue.

ALGINATE¹ IMPRESSION TECHNIQUE

Uses in Lower Denture Prosthesis

GEORGE D. MALLORY, JR.

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The combination of obtaining stability, function, comfort, and esthetics in a lower denture has always been one of the greatest problems of the dental profession. There are many variations in techniques for obtaining this result. The impression is the first consideration. This article describes a technique for obtaining a mucostatic impression using alginate material as the impression medium. The details of mucostatic impressions have well been described by Harry L. Page and many others. The embodying principle is to obtain an undistorted reproduction in the denture base of the tissue at rest. Tissue cannot be compressed; it can only be displaced. Therefore, if we can make a denture base that will fit so perfectly that no tissue is displaced, the lower denture will be supported by the hydraulic action of the tissue. In theory this gives unlimited support. In practice it results in tissue stimulation without trauma (assuming correct articulation). The following technique is aimed toward this end.

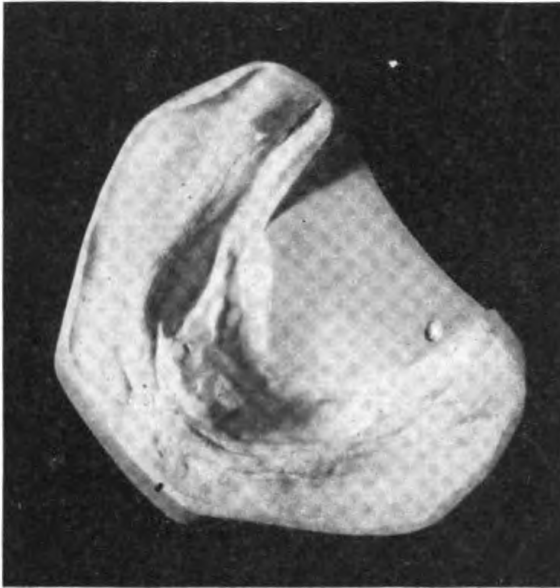
EXAMINATION

The patient's mouth has been prepared in all respects for prosthetic treatment. A digital palpation of the ridges is necessary to determine the type of tissue, thickness and mobility, its attachments, and the shape of the bone. With this knowledge, one will be better able to judge the accuracy of the final impression.

PRELIMINARY IMPRESSION

The preliminary impression may be taken in any manner desired. On the average ridge, however, it is often possible to get the master impression at the first sitting using a metal stock tray with alginate.

¹ Commercial forms of alginate are Coe-Loid, DP, Zeelex, etc. See Supply Catalog, Medical Department, U. S. Navy, Stock No. 11-950.



1. Preliminary model. This impression was taken in compound. Note stretched, displaced tissue.

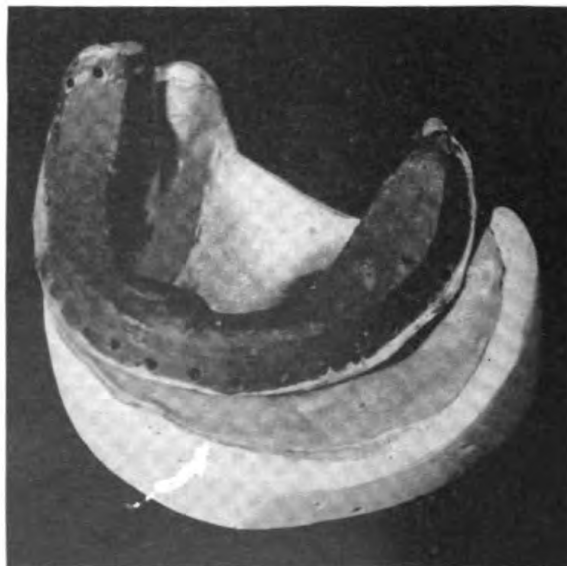
Usually, it is slightly distorted where the tray has impinged on soft tissue, or when the material is not adapted closely enough to the tray thus leading to distortion. A plaster model is poured into the preliminary impression. A baseplate is adapted as a tray over the model. Trim it about 2 mm. short of all tissue attachments. Another tray of the same material is adapted over this tray and trimmed, thus making two trays, one inside the other (fig. 2). The outer or larger tray is reinforced

with a bur and compound to prevent distortion. A handle is formed on the outer tray with compound.

The inner or liner tray is tried in the mouth. Due to its light weight, any soft tissue interference shows up readily. It should lay on the ridge, and the patient should be able to open wide without disturbing it. If it is overextended, place it in the outer tray and trim them both down together. The liner tray is now serving as a pattern, so that when the liner fits without impingement, so will the outer oversized tray.

THE MASTER IMPRESSION

The outer tray is used for this impression. This enlarged tray makes room for the impression material by the thickness of the liner tray. With a No. 5 or No. 6 bur, holes are placed in the tray about every quarter inch. These are necessary to hold the alginate to the tray, and to assure equalized pressure as the material is being put to place.



2. Preliminary impression model, showing liner tray and final reinforced impression tray.

The alginate is mixed according to the manufacturer's specifications. Too fast a set should be avoided. The tissue must be thoroughly dried with gauze swabs and kept dry until just before the impression is put to place. This is important. The patient should relax the cheek muscles and tongue while the impression is being inserted and while the material is setting. In seating the tray with the impression material, the cheeks are retracted as far as possible so that



3. Final master model. Note folds and detail in the tissue, showing the tissue was at rest.

no air bubbles are trapped along the side of the ridge or in the mucobuccal fold. While the cheeks are held with thumbs and second fingers, the tray is guided with the first fingers. The impression must *float to place*, and it must be taken *without the tray touching the tissue at any point*. The fingers steady and guide the tray but exert no pressure. The patient should be completely relaxed and is instructed not to swallow or move until the set takes place.

It is sometimes helpful to have the patient raise the tongue slightly as the impression tray is being inserted. If difficulty is encountered due to trapped air bubbles, some of the alginate may be placed in the sulcus of the cheek just before seating the tray. After the set, the seal is broken and the impression is gently removed. Dry the impression and check for accuracy and completeness.

The following factors should be noted:

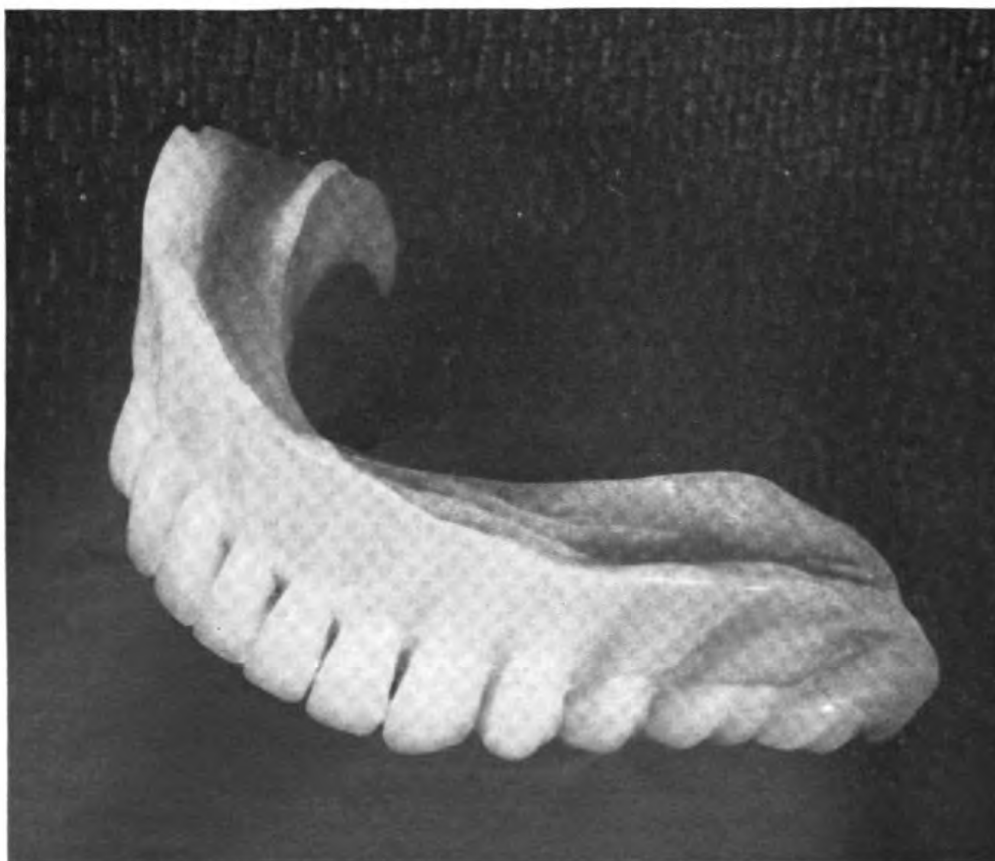
1. All peripheral borders must be supported by the tray.
2. Ideal thickness of the alginate is from 1 to 3 mm.

3. Fine detail should be reproduced.
4. The impression should extend distally to include the retromolar pad area.

LABORATORY PROCESS

There are two common faults to avoid in processing. First, in adapting acrylic to the stone model, the use of foil or cellophane will cause enough difference to ruin an otherwise perfect fit. A suitable model glaze is used and alginate solution is recommended. Second, the acrylic must be cured slowly at controlled temperatures. It must never be boiled. The following schedule for curing is suggested:

- (a) Packed cases are placed in a cold water bath.
- (b) Heat is increased to 165° F. in approximately 3 hours.
- (c) A thermostat holds the water temperature constant (minimum 6 hours).
- (d) Upon completion the water is allowed to cool naturally. Part of the water may be removed to hasten cooling, but the flasks should take about 3 hours to cool. Bench cooling is too rapid and will cause excessive warpage.



4. Finished denture Note lack of peripheral "roll."

For an accurate impression technique it is essential to reproduce as much as possible of the detail and accuracy in the denture base. Metal alloy has proved to be the most accurate base when available.

PERIPHERY

The mucobuccal fold is not filled with the usual peripheral roll. Instead, the periphery tapers to a "knife edge" finish exactly at the point where the tissue starts to reflect from the ridge. Several things are accomplished by this, namely:

1. The denture is made lighter and has a more "natural feeling."
2. The hydraulic action of the cheeks acting on a peripheral roll, which tends to force air and food beneath the denture, is eliminated.
3. The "knife edge" periphery aids in preventing small food particles from getting under the denture.

Unless the periphery is overextended, the sharp "knife edge" finish will not irritate the tissue. Both buccal and lingual flanges are treated in the same manner.

SUMMARY

The mucostatic impression technic for lower dentures using alginate material presents several distinct advantages, as follows:

1. It presents an easy, rapid method of obtaining accurate, non-distorted, detailed impressions of a lower ridge.
2. All types of mouths can be accommodated, but it is especially suited for badly resorbed ridges, where an excess of soft, flabby tissue is present.
3. The laboratory process must be carried out with exacting thoroughness in order to reproduce an accurate denture base.
4. The "knife edge" periphery gives the denture a more natural feeling, and assures its seal.
5. The denture base will not cause irritation, assuming the articulation is correct.
6. Alveolar bone is preserved and the patient has a comfortable, useful restoration.

REFERENCES

1. CHATRAND, B. O.: California County Dental Society Clinics, 1944.
2. PAGE, H. L.: Annual Ticonium Refresher Course, 1943.
3. DENEN, H. E.: Negative Pressure Impressions for full dentures, J. A. D. A., 31: 888, July 1944.
4. ADDISON, P. I.: Mucostatic Impressions. J. A. D. A., 31: 941, July 1944.

INSULIN AS A SEDATIVE IN TREATMENT OF PSYCHOTIC PATIENTS IN A TROPICAL HOSPITAL

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Physical activity of excited psychotic patients in the Tropics must be reduced in order to prevent undue loss of fluids and weight.

Rennie¹ reported that sedative action and improvement were obtained when insulin was used in amounts well below that which produced clinical shock. Following his procedure the treatment was used on 21 psychotic patients in a forward area tropical hospital while they were awaiting evacuation. Fourteen of these patients were diagnosed as schizophrenia, six as manic depressive psychosis (five in the manic and one in the depressed phase), and one was diagnosed as psychosis with psychopathic personality. All were young males in good physical condition.

Treatment consisted of an initial dose of 10 units of insulin which was increased daily by 10 units until the desired results were obtained. The insulin was given subcutaneously at 0700 daily, breakfast was omitted, and the patients kept in bed for the next 4 hours, at the end of which time they were given 400 cc. of 25-percent solution of corn syrup (Karo) by mouth. During the entire period they were under careful observation with pulse, respiration, and general condition carefully noted, and blood pressure and rectal temperature taken every half hour, or more frequently if indicated.

The effect desired was one in which the patient became less active and slightly drowsy. The treatment was terminated immediately if the drowsiness became deep or if the pulse, temperature, or general condition indicated that he might be approaching shock. In general, a slight fall in temperature, some slowing of pulse, and mild cold perspiration with the mild drowsiness were indications of the desired

¹ RENNIE, T. A. C.: Use of insulin as sedation therapy; control of basic anxiety in psychoses. *Arch. Neurol. & Psychiat.* 50: 697-705, December 1943.

sedation. When the dosage was adequate to produce these mild symptoms the dose was not increased but was maintained at this level, usually averaging from 40 to 70 units, until the patient was evacuated from 1 to 4 weeks later. If symptoms were increased beyond these optimum ones, the treatment was terminated immediately by the administration of the syrup solution. It was found generally that the optimum condition could be controlled readily.

Insulin, used in this manner, presented several advantages over more commonly used sedatives. Its sedative effect continued well after the termination of the treatment, appetites were increased, and food and water were taken much better. Generally, the care of the patients was simplified; they were quieter, easier to control, in better contact, and showed a general lessening of their psychotic symptoms. Their improved condition greatly facilitated their evacuation.

Although the series is small, the results seem definite and advantageous. It is our opinion that this is a useful procedure in the management and treatment of psychotic patients in forward area tropical hospitals.



PREPARATION OF DRINKING WATER FROM SEA WATER

The author describes the experiments to determine the materials to be used in the briquettes and the most suitable containers for them. It had been found that briquettes containing barium monoxide split their containers and disintegrated which "was probably due to the expansion of the barium monoxide which had undergone hydration at the expense of the moisture present in other constituents of the briquettes." The barium monoxide was replaced by barium hydroxide octohydrate and the proportion of fuller's earth increased.

"The method finally developed consisted in treating sea water with briquettes of a reagent containing silver zeolite, barium hydroxide octohydrate, silver oxide, fuller's earth, and graphite.

"The proportion by weight, of the various ingredients was then as follows: Silver zeolite, 79.1 percent; barium hydroxide octohydrate, 9.5 percent; fuller's earth, 9.0 percent; graphite, 1.9 percent. This material gave briquettes of good shape and after storage for 6 months the wrapped briquettes showed no signs of distortion."

This method for treating sea water to produce drinking water was developed for use by air crews adrift in rubber dinghies on the open sea.—INGLESON, H.: Preparation of drinking water from sea water. J. Soc. Chem. Indust. 64: 305-309, November 1945.

INGROWN TOENAIL

A SIMPLIFIED OPERATIVE TREATMENT

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Ingrown or ingrowing toenail is a condition in which the lateral edge of the nail has become embedded in the soft parts of the lateral nail groove causing inflammation of the soft parts about the embedded portion of the nail.

INCIDENCE

In our experience the incidence in the United States Navy is high, two to three cases being seen each week in a naval dispensary caring for a station with personnel ranging from 2,000 to 3,000 men.

Heifetz (1), after an extensive review of the literature in 1937, reported that the condition is most prevalent in young male adults. He states that Dardignac, who had under his care 6,000 infantrymen over a period of 7 years, observed that 2 percent developed this affection at one time or another. Among civilians, Heifetz reports 15 males and 17 females in his series of 32 patients while Keyes (2) reports that three-fourths of a series of 110 patients were females.

ETIOLOGY

Most authorities agree with Bartlett (3) that the etiology in the majority of cases seems clearly to be the wearing of shoes that are too narrow and often too short. Dr. Deraldo Campos, resident physician for the 8,000 people on the Utinga Sugar Plantation near Maceio, Brazil, tells us that he has never seen or heard of a case of ingrown toenail among native workers who do not wear shoes. In addition to poorly fitting shoes, Christopher (4) adds the etiological agents of stockings that are too tight and the ill-advised custom of trimming the corners of the nails off down below the skin edge. Pardo-Castello (5) believes that part of the etiology of this condition is a special configuration of the nail which is more convex than normal and which, he states, is often familial.

ANATOMY

Graham (6) states that a proper knowledge of ingrown toenail and its treatment must commence with a study of the region of the nail. Gray's *Anatomy of the Human Body* (7), Maximow's *Text-Book of Histology* (8), and Heifetz's comprehensive article on this subject are the sources for the following brief résumé:

A nail is a portion of the epidermis modified for special function. The nail is implanted into the skin proximally by the *root* and has a *distal free edge*. The exposed part of the nail between the root and free edge is called the *body* of the nail. The lateral margins of the nail are imbedded in and overhung by margins of normal skin. The *eponychium* or *cuticle* is a thin layer growing distally from the *stratum corneum* of the skin which overhangs the root of the nail and the *lunula*. The lunula is the whitish half-moon shaped area that may be seen at the proximal margin of the body of the nail.

The most important part of the anatomy of the nail in relation to the treatment of ingrown toenail is the matrix. The *nail plate* lies upon a white cartilage-like layer, called the *nail bed*. The *matrix* is that portion of the nail bed underlying the lunula and the consensus of authoritative opinion is that growth of the nail takes place from the matrix. There is, however, controversy as to whether or not the nail also grows from the fold of the eponychium overlying the nail. Heifetz states that if the nail plate is removed and the matrix destroyed, the nail bed may secrete a thin cornified layer that lacks the texture, rigidity, and the structure of the nail plate and is not regrowth of nail plate from the eponychium.

On the other side of the question, Graham states that a thin layer of the cuticle must be removed with the matrix, especially near the root because at that point the nail grows from cells "above and below."

In rebuttal, Keyes, after studying the results of 110 operations for ingrown toenail by different surgeons in three St. Louis institutions, reports that no recurrence could be ascribed to growth of new nail from eponychium. He states that since the eponychium ordinarily was not excised at operation, this structure would seem to lack the nail-forming function attributed to it by some authors.

Heifetz emphasizes another important point in nail growth: That every part of the nail plate grows straight out from the corresponding part of its root, e. g., the lateral side of the root will eventually grow out to form the lateral side of the free edge.

PATHOLOGY

Whatever the etiology, there is common agreement that the soft tissues of the nail wall are pressed against the sharp lateral nail edge,

resulting in a break in the skin of the nail wall with subsequent infection of the soft tissues, ulcer formation, and, finally, the heaping up of exuberant granulation tissue (so-called proud flesh). Ninety percent of our cases have been on the outer margin (the side opposite that side next to the second toe) which is in agreement with Christopher's statement that this common ailment is generally seen on the outer margin of the great toe, although sometimes on the inner margin. It is debatable whether or not ingrown toenail ever occurs on any other toe. All of our cases have been on the great toe.

SYMPTOMATOLOGY

The pathology explains well the symptomatology. As the lateral edge of the nail is pressed more deeply into the soft tissues, walking becomes more painful. Then the skin of the lateral nail wall is torn and slight secretion results which in turn becomes infected with the production of pus. The paronychia tissue on the side of the offending lateral nail edge appears red and swollen and finally exuberant granulation tissue appears along the margin. By that time the pain of walking may have become incapacitating.

DIAGNOSIS

The diagnosis of this condition is no problem although Graham cautions that ringworm should be borne in mind as an occasional cause of error.

TREATMENT

Treatment may be conveniently discussed under three headings: Prophylactic, palliative, and operative.

Prophylactic.—There is common agreement that the most important part of the treatment of ingrown toenail is prophylactic. Proper-fitting footwear is of primary importance. The longer shoe, with a soft, high toecap, straight last, broad toe, and a low heel should be worn. Socks and stockings should not fit too tightly.

The other fundamental in the prophylaxis of ingrown toenail is the proper cutting of the nail. The nail should be allowed to grow fairly long and then cut straight across. Toenails should not be rounded off at their corners as finger nails are when they are manicured. If the visible corner of the nail is cut off, frequently a buried projection (spur) of the nail is left. This spur will aggravate an incipient tendency towards the development of an ingrown toenail. Such a spur was found in a high percentage of our patients when the lateral offending edge was removed.

Palliative.—Many forms of palliative, conservative, or nonoperative treatment have been prescribed for the early cases when there is simply a moderate amount of redness and tenderness of the soft tissues

about the offending nail edge and the soft tissues have not become eroded or secondarily infected. O'Donoghue (9), believing that the most common factor in the etiology of this condition is an increased convexity of the nail, recommends, as conservative treatment, breaking down the arch of the nail by scraping the nail thin in its central portion. The majority of conservative treatments have aimed at separation of the nail from the soft parts. Many substances (lint, cotton, silver plate, tinfoil) have been used. The cotton and lint have been soaked in various solutions (glycerin, silver nitrate, collodion) and placed under the embedded edge of the nail plate. Christopher states that in a few mild cases the wearing of larger socks and broad-toe shoes with the daily packing of small wisps of cotton under the offending nail edge will result in curing the incipient condition.

But as Heifetz states: "All conservative measures have the limitation that they are often not curative but palliative." This certainly is unsatisfactory in treatment of military personnel. And as Vernon (10) writes, even when conservative treatment is effective, it is at the cost of from 4 to 6 weeks of continuous care and the discomfort suffered during the course of therapy. The requirement of daily visits to sick call and the continued discomfort over a long period of time make conservative treatment further unsuited for military personnel.

In our experience, the condition in the great majority of patients, when first seen by the medical officer, is far advanced with the nail edge deeply embedded in the paronychia tissue. There is usually a surrounding cellulitis and the formation of considerable granulation tissue. Conservative methods, if any, have been attempted by the patient or hospital corpsman and have failed and, finally, when walking becomes too painful, the attention of the medical officer is called to the condition. Thurlow's (11) experience among civilians has been similar and he states that by the time the average case reaches the office, the surrounding soft parts are thickened and infiltrated and palliative measures are a waste of time.

When the cellulitis is extensive and painful the patient is put at bed rest with massive, hot, wet, saturated magnesium sulfate-solution dressings to the ankle, foot, and toes of the affected extremity. When the cellulitis is less extensive and painful a sulfadiazine ointment and light gauze pad dressing is applied over the affected side of the toe after a daily 20-minute soak in a solution of magnesium sulfate and the patient may remain ambulatory. After from 48 to 72 hours of either of these treatments the patient, in most cases, is ready for operation.

Operative.—Many operations have been devised for the cure of this incapacitating condition.

Bartlett (3) introduced an operation differing in principle from all others in that a wedge of soft tissue is removed from the side of the toe through an uninfected field. When the skin edges of this incision are sutured together the nail wall is pulled away from the edge of the nail.

Ney (13) describes an elaborate operation solely on the soft parts, the nail not being disturbed, in which two pedicle grafts are laid back, the soft tissues adjacent to the nail removed, and the flaps replaced. Two or three weeks in bed postoperatively are required.

Heifetz objects to operations solely on the soft parts because of the long period of healing required, the high percentage of recurrences, and the resulting scar often being tender and annoying.

Ferguson (12), however, advocates Bartlett's operation on those patients in whom the pain from ingrown toenail is not associated with an infection along the edge of the nail.

Christopher states: "A very simple and often curative method of treating ingrown toenail is the avulsion of the entire toenail under gas anesthesia. The ulcerated nail sulcus has ample time to heal as the new nail is growing out, and there may be no recurrence." Keyes, in his study of the results of 110 operations for ingrown toenail, found that 7 out of 9 cases recurred after this method, an incidence of 77.8 percent which was by far the highest percentage of recurrence occurring after any of the common methods of operative treatment. He joins Heifetz and Bartlett in condemning this method of treatment.

One cognizant of the anatomy of the toenail and the process by which it grows from its matrix will realize that prevention of recurrence of ingrown toenail cannot be assured unless the matrix along the offending nail edge is removed. The fundamental of the operative treatment of this condition is the removal of the lateral edge of the nail which is so painfully embedded in the paronychia tissue and, by thoroughly removing the matrix of this lateral edge, preventing this part of the nail plate from ever growing again. This is the principle of the Winograd (14) operation which he introduced in 1929.

Many authors advocate the excision of the overhanging soft tissue as well as the offending lateral nail edge. It occurred to Winograd that it was unnecessary to remove the hypertrophied, granulated paronychia tissue and that this tissue was in a chronic inflammatory state as a result of irritation of the lateral nail edge and might be expected to return to normal after removal of the cause of irritation. This has proved true in all of our cases.

The method of operation for ingrown toenail that will be presented here has evolved from attempts to further simplify the original Winograd technique and any of its many modifications that have been presented in the literature. This method has been used in over 50 cases

by the author during the past 2 years. The follow-up on these cases has been poor because of the rapid turnover of personnel. However, 10 of these cases have been followed for over 6 months without recurrence. Colleagues of mine who are using this method report that it has been uniformly successful and so we are encouraged to present the method in detail.

OPERATIVE PROCEDURE

1. No preoperative medication is necessary.
2. After thoroughly scrubbing the affected toe with soap and water



1. Showing point of first injection of local infiltration anesthesia.

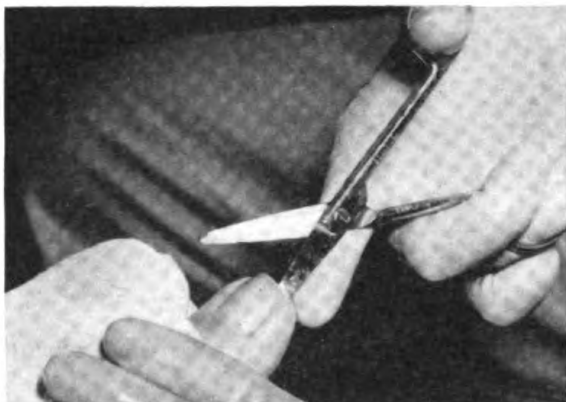


2. Showing point of second injection of local infiltration anesthesia. Note the blanching of the lateral side of the toe that has been anesthetized by the first injection of the local anesthetic.

for 5 minutes, the entire toe is painted twice with tincture of merthiolate.

3. For anesthesia procaine hydrochloride, 0.5 percent, without adrenalin is used. A long 21-gage needle attached to a 3-cc. Luer-Lok syringe is ideal for injecting the anesthetic solution because it has been proved that considerable pressure is necessary to obtain optimum anesthesia. The first injection is made into the skin of the tip of the toe on the side of the offending nail (fig. 1). With continuous injection of the anesthetic solution the needle is gradually inserted deeply along the lateral nail wall. Injection of from 2 to 3 cc. of the anesthetic solution will effectively anesthetize the entire lateral nail wall.

The second injection of the anesthetic solution is made through the already anesthetized lateral side of the toe, or nail wall, at the base of the toenail. With constant injection of the anesthetic solution the needle is inserted deeply under the root of the nail (fig. 2). Two



3. Showing the position of the blade of the scissors under the lateral side of the nail plate ready to pry it from the nail bed.

Although local infiltration anesthesia has been used in all cases there has been no postoperative extension of cellulitis. Furthermore, with unilateral infiltration anesthesia there is no danger of gangrene of the toe.

4. One blade of a pointed scissors is inserted under the free edge of the nail along the lateral margin of the offending side of the nail (fig. 3).

5. A simple prying movement of the scissors blade will elevate the



4. Showing the lateral border of the nail plate after it has been pried loose from its nail bed. Note that the root (of the lateral border only) of the toenail also has been pried out and is lying upon the eponychium.

lateral margin of the nail plate easily out of the groove in the skin of the nail wall in which it normally lies. The root of the nail along the lateral margin will also be pried out from underneath the eponychium at the same time by this maneuver (fig. 4). Neither eponychium nor the soft tissue of the lateral nail wall is incised.

6. A $\frac{1}{4}$ -inch strip of the lateral margin of the nail plate is then cut with scissors (fig. 5) and removed.

7. The pointed ends of the scissors are used to thoroughly scrape out the matrix that would give rise to another offending lateral nail margin (fig. 6). *This is by far the most important step in the operation.* It is necessary to remove every bit of the matrix because one small fragment left behind will give growth to an annoying island of nail. The matrix

cubic centimeters of the anesthetic injected with pressure into this region will effect complete anesthesia for the operation. Bilateral nerve block, as in the Winograd technique, is not used.

A tourniquet around the base of the toe has proved unnecessary. The pressure of the injected anesthetic solution effects adequate hemostasis for the very short operative procedure.

appears as a white, shiny, cartilaginous substance which may be expected to extend from a point about 8 mm. distal from the interphalangeal joint to the distal margin of the lunula. The scraping out of all of the matrix is not easy and must be done vigorously, scraping right down onto the bone of the terminal phalanx. Particular care must be taken in the furthest corners of the nail bed from which the lateral nail margin of the nail plate has been removed.

8. The bed from which the lateral margin of the nail plate has been excised is then packed with a pledget of cotton which has been impregnated with sulfadiazine ointment. This effectively controls postoperative bleeding.

9. Finally, a thin gauze pad is applied to the toe as a dressing and held in place with 1-inch gauze bandage and adhesive tape. This bandage is so thin that the patient can wear his usual shoe.

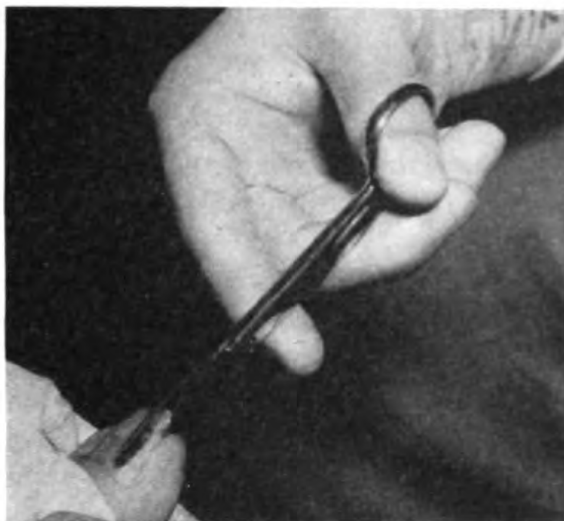
POSTOPERATIVE CARE

None of these patients needs hospitalization or light duty. They are encouraged to walk immediately, to do so without complaint. The dressing is changed 48 hours postoperatively and the cotton packing removed. Thereafter dressings need changing only as they become soiled.

CONCLUSIONS

1. Ingrown toenail is a common condition in Navy personnel.

2. Ingrown toenails seems to be caused by shoes that



5. Illustrating the cutting off of the lateral border of the nail plate.



6. Showing the scraping out of the matrix with the pointed scissors.

are too narrow and/or too short, and the incorrect cutting of the toenails.

3. Authorities agree that the nail plate grows from the matrix but there is disagreement as to whether or not the eponychium contributes to the growth of the nail plate.

4. Most cases of ingrown toenail occur on the outer margin of the great toe.

5. Palliative, conservative, or nonoperative treatment is of little value in service personnel because of the time consumed in treatment, lack of certainty of cure, and the usual far-advanced stage of the condition when first seen by a medical officer.

6. There is disagreement as to whether or not operations on the soft parts of the toe alone without removal of the offending nail edge and its underlying matrix will effect a permanent cure of ingrown toenail.

7. Avulsion of the entire toenail without destruction of the underlying matrix is condemned because of the high percentage of recurrences after this procedure.

8. A simplification of the Winograd technique for operative treatment of ingrown toenail enables the patient to walk immediately and continually postoperatively.

9. The most important part of this treatment is the thorough removal of the matrix giving rise to the growth of the offending lateral nail margin.

SUMMARY

After a review of the available literature, the definition, incidence, etiology, pathology, symptomatology, diagnosis, and treatment of ingrown toenail has been discussed. The details of a simplification of the Winograd technique, which has proved to be an effective treatment in over 50 cases, are presented. This technique differs from the original and its many modifications that have been previously reported in the following respects.

1. A tourniquet is unnecessary for hemostasis which is effected by the pressure of local infiltration anesthesia.

2. Neither the eponychium nor the tissue of the lateral nail wall is cut.

3. A special shoe is not necessary postoperatively.

4. The patient is able to resume all of his duties immediately postoperatively without hospitalization.

REFERENCES

1. HEIFETZ, C. J.: Ingrown toenail; clinical study. *Am. J. Surg.* **38**: 298-315, November 1937.

2. KEYES, E. L.: Surgical treatment of ingrown toenails. *J. A. M. A.* 102: 1458-1460, May 5, 1934.
3. BARTLETT, R. W.: Conservative operation for cure of so-called ingrown toenail. *J. A. M. A.* 108: 1257-1258, April 10, 1937.
4. CHRISTOPHER, F.: *Minor Surgery*. 5th edition. W. B. Saunders Co., Philadelphia, 1944. pp. 787-791.
5. PARDO-CASTELLO, V.: *Disease of the Nails*. 2d edition. Charles C Thomas, Springfield, Ill., 1941. p. 44-47.
6. GRAHAM, H. F.: Ingrowing toenail. *Am. J. Surg.* 6: 411-413, April 1929.
7. GRAY, H.: *Anatomy of the Human Body*. Lea & Febiger, Philadelphia, 1942. p. 1086.
8. MAXIMOW, A. A.: *A Text-Book of Histology*. W. B. Saunders Co., Philadelphia, 1930. p. 422-425.
9. O'DONOGHUE, D. H.: Treatment of ingrown toenail. *Am. J. Surg.* 50: 519-522, December 1940.
10. VERNON, S.: Ingrown toenail; operation by electrosurgery. *Am. J. Surg.* 42: 396-397, November 1938.
11. THURLOW, A. A.: Defects of toenails; ingrown and vertical. *Am. J. Surg.* 8: 312-314, February 1930.
12. FERGUSON, L. K.: *Surgery of the Ambulatory Patient*. J. B. Lippincott Co., Philadelphia, 1942. p. 680-685.
13. NEY, G. C.: An operation for ingrowing toenails. *J. A. M. A.* 80: 374-375, February 10, 1923.
14. WINOGRAD, A. M.: Modification in technic of operation for ingrown toenail. *J. A. M. A.* 92: 229-230, January 19, 1929.



"GRAMICIDIN S": OVER-ALL CHEMICAL CHARACTERISTICS AND AMINO-ACID COMPOSITION

Author's summary.—1. It is probable that the antibacterial substance gramicidin S is a cyclopeptide hydrochloride having a stoichiometric minimum unit formed from one residue each of *L*-ornithine, *L*-proline, *L*-valine, *L*-leucine and *D*-phenylalanine. The unit possesses one free amino-group, no free carboxyl groups, and one residue of chloride.

2. The relationship of gramicidin S to tyrocidine hydrochloride is emphasized, and a plea is made for renaming gramicidin S to bring out this relation.—SYNGE, R. L. M.: "Gramicidin S": Over-all chemical characteristics and amino-acid composition. *Biochem. J.* 39: 363-367, October 1945.

WOMEN RESERVES FOR OVERSEAS DUTY¹

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Now that members of the Women's Reserve are permitted to serve their country outside its continental limits, it is possible that WAVES processing centers may be set up at other naval activities. It is believed, therefore, that some of the steps of procedure and medical problems involved in their medical processing at this station will be of interest.

A Bureau of Naval Personnel communication, dated 29 September 1944, set up the requirements to be met in making application as follows:

(a) Only those who have served 6 months on continuous active duty, exclusive of time spent in training, will be eligible. When two individuals are equally well qualified in other ways, preference will be given to the one with longer service.

(b) Only those with a good-conduct record and who have not had a court-martial sentence within the last 6 months, a good health record with no misconduct status, and a good work record will be considered.

(c) Only those who have demonstrated in their military service a sense of responsibility, maturity, adaptability, and emotional stability will be considered for selection.

(d) Only those who are free from any form of dependency which would require their presence in the United States will be considered for selection. Dependency arising subsequent to assignment outside the continental United States will not normally be considered as reason for returning to the United States. Individuals who have at any time submitted a request for transfer or discharge based on dependency are not eligible for overseas duty.

(e) Applicants must volunteer for duty outside the continental United States as such. Preference of area may be registered, but definite assignment to the referred area cannot be guaranteed.

¹ Received for publication 9 May 1945.

(f) Overseas assignments are normally for a minimum of 18 months. There is no commitment, however, to return personnel to the United States at the end of this period.

(g) No leave to return to the United States will be granted while on overseas assignment. The local leave policy of each area shall be the same for all personnel in the area.

(h) Individuals who have submitted applications will be considered available for selection unless cancellation of application is submitted through official channels before receiving orders for transfer.

The foregoing requirements are given in detail to show how carefully the Bureau of Naval Personnel planned to meet situations beforehand, and which, if not rigidly adhered to, would otherwise result in disqualification at the distribution center.

Following a request from the Bureau of Naval Personnel to the Bureau of Medicine and Surgery to establish procedures for administering a standard physical examination and any necessary inoculations at a central distribution center, the following instructions were issued:

"1. A standard physical examination of all individuals should be conducted as outlined by paragraph 1532, Manual of the Medical Department, prior to transfer for duty in the tropics or Alaska, and by article 1142 (3), Navy Regulations, for the transfer of enlisted personnel from one duty station to another. Gynecological examination should be conducted only when indicated in the judgment and discretion of the examining medical officers. Health record abstracts shall be carefully checked in all cases and revaccination or reinoculation administered as required.

"2. Individuals found not physically qualified for overseas duty shall be so reported to the commanding officer of the distribution center and appropriate recommendation made by the examining medical officer. Report of a disqualifying examination shall be forwarded to the Bureau of Medicine and Surgery on NavMed Form Y in duplicate, and notation of examination in all cases shall be entered on Form H-8 of the Health Record."

In order to efficiently carry out the plans for overseas medical processing, it was necessary to know how many WAVES were to be examined, how long they would be on the station, how many groups would be sent here and how often, or what interval between groups. The complete answer to these questions, of course, was not forthcoming, but sufficient information was obtained to plan a definite physical set-up. A new medical ward for WAVES had recently been put into commission in the main dispensary, and several rooms, in an advantageous position near the main corridor were converted

into examining rooms by the simple expedient of removing the beds and other equipment. At the same medical activity there was already in existence a medical processing center for men going overseas, and much was gained by a study of methods, procedures, and results of that activity. With some alterations the procedure already in existence for the men was tailored to fit the requirements of the Women's Reserve.

Each day at 1300, a list of names of those to be examined the following day was obtained from the personnel office, and the health records were carefully scrutinized. Particular attention was given to past medical history, admissions to sickbay, etc. Adverse findings were indicated by means of a check mark on the upper right-hand corner of the I. B. M.¹ card, prepared in advance by the personnel office. These findings were checked the next day with the applicant, following the physical examination. If for any reason there was no health record, a skeleton health record was made. A check was also made to see that each Wave had two identification tags; if not, these were prepared and delivered the following day. Inoculations were carefully checked, and if the required inoculations and immunizations were not shown on the health record to have been given, this was indicated on the I. B. M. card. The following day, the group to be examined presented itself at 0900, using a separate entrance to the area marked off as "Restricted" to the rest of the main dispensary personnel. Examination began promptly as scheduled. The examinees were admitted to room 1 in groups of five, where they quickly undressed and each one stored their gear in a numbered compartment. After donning a robe and slippers, they were interviewed by a well trained Wave pharmacist's mate, first class, who, on the already-prepared I. B. M. card, took a careful menstrual history. As these five applicants moved on to room 2, a new group of five entered room 1. In room 2, blood pressure, pulse, and eye chart readings were taken as well as examination for skin conditions, varicosities, hernia, hemorrhoids, and orthopedic conditions. In room 3, an otoscopic examination of the ears, nose, and throat examination, as well as an auscultatory examination of the heart and lungs, was done. In the last room the applicants were examined by a dental officer who passed on dental qualifications, and whose technician made appointments for any minor repair work that could be done while the Wave was still present at the station. The hospital corpswave at the inoculation table checked the I. B. M. card and gave any indicated inoculations or immunizations and recorded those given on the I. B. M. card. The applicants for overseas duty then turned in their

¹ International Business Machine.

I. B. M. cards to the hospital corpswave at the health record desk. Inoculations given were immediately entered on Form H-3. If there were no adverse findings during the course of the examination, the health record was stamped, dated, and signed by the senior medical officer conducting the examination.

The hospital corpswaves and nurses are instructed to be particularly watchful for history, signs, and symptoms of anemia, menstrual disorders, and other conditions which may be aggravated by residence in tropical climates.

In case the I. B. M. card indicated an unfavorable medical or menstrual history, or if a marginal or disqualifying defect is noted, the applicant is told to stand-by and see the medical officer before leaving the processing center. Gynecological examinations are made when indicated by menstrual history or health record entries.

At a stated time the entire group is sent to another building which is set up for the taking of photofluorograms. Trained x-ray technicians accomplish the photofluoroscopy in a minimum of time. The films, taken on 35-mm. negatives, in strips of 30 to the roll, are developed and read by the medical officer in charge. The strips are all numbered serially, and any chest picture with other than negative findings is noted and rechecked on a 14 by 17 chest film. A separate entry is made in the health record on Form H-8 stating the result of the photofluorogram and signed by the medical officer making the reading.

The procedure, followed in those individuals found not physically qualified for overseas duty, is that as directed by the Bureau of Medicine and Surgery. An entry is made on Form H-8 of the health record stating that they are not qualified and the reason given for disqualification. A letter is sent to the commanding officer of the distribution center reporting the facts to him. Report of disqualifying examination is forwarded to the Bureau of Medicine and Surgery on NavMed Form Y in duplicate. In addition, to expedite local handling of the case, an "unavailable" chit, in triplicate, is made out. One copy is sent to the I. B. M. office, one to the personnel office of general detail, and one to the record office.

Preliminary reports show a 1.16 percent rejection for overseas duty. Sixty-six one-hundredths of 1 percent of the total 1.16 percent was disqualified for physical reasons only, and the remaining one-half of 1 percent was disqualified following neuropsychiatric consultation as temperamentally unsuited for overseas duty.

It is not to be expected, nor anticipated, that the districts within continental United States give up the best of their personnel to make overseas quotas; but in view of the peculiar problems attendant with

such duty, it is felt that a more careful selection of the applicants submitting requests should be made at the point of origin. More attention given to compatibility, emotional stability, and maturity in the selection of candidates will result in a higher acceptance of individuals temperamentally suited for overseas duty.



POSTWAR PLANS FOR TROPICAL MEDICINE IN THE NAVY

Many inquiries are being received by the Research Division, Bureau of Medicine and Surgery, in connection with the Navy's prospective plans for carrying on medical research, and particularly tropical disease research, during the postwar period. Currently, investigative work is in progress at 11 large naval medical research units, where numerous tropical medicine investigations are being carried out along with medico-military projects of other types. These facilities will be continued in the future.

Postwar plans have been completed for cooperative research projects with civilian agencies, and funds have been made available for such investigative work. In addition, legislation is being proposed to establish as a regular component of the Navy, a group of scientists in uniform whose duties will be exclusively concerned with medical research. This group, according to plans, will be composed of medical officers and individuals holding doctorates in sciences allied to medicine. There is further proposed a similar group of scientists who will conduct studies within the naval organization but as civilian service status.

Active support which has been generally forthcoming in effecting the above program indicates that the postwar naval medical research program will include not only continuation of the existing establishments for research, but also an expansion of the entire program on a long range basis.



THERAPEUTIC EFFECT OF STREPTOMYCIN IN EXPERIMENTAL MURINE PERTUSSIS

Streptomycin exerts a protective therapeutic effect on the course of experimental murine pertussis as indicated by a significant reduction in the mortality rate and the disappearance of the organisms from the lungs of the surviving mice.—BRADFORD, W. L., and DAY, E.: Therapeutic effect of streptomycin in experimental murine pertussis. *Proc. Soc. Exper. Biol. Med.* 60: 324-325, December 1945.

CLINICAL NOTES

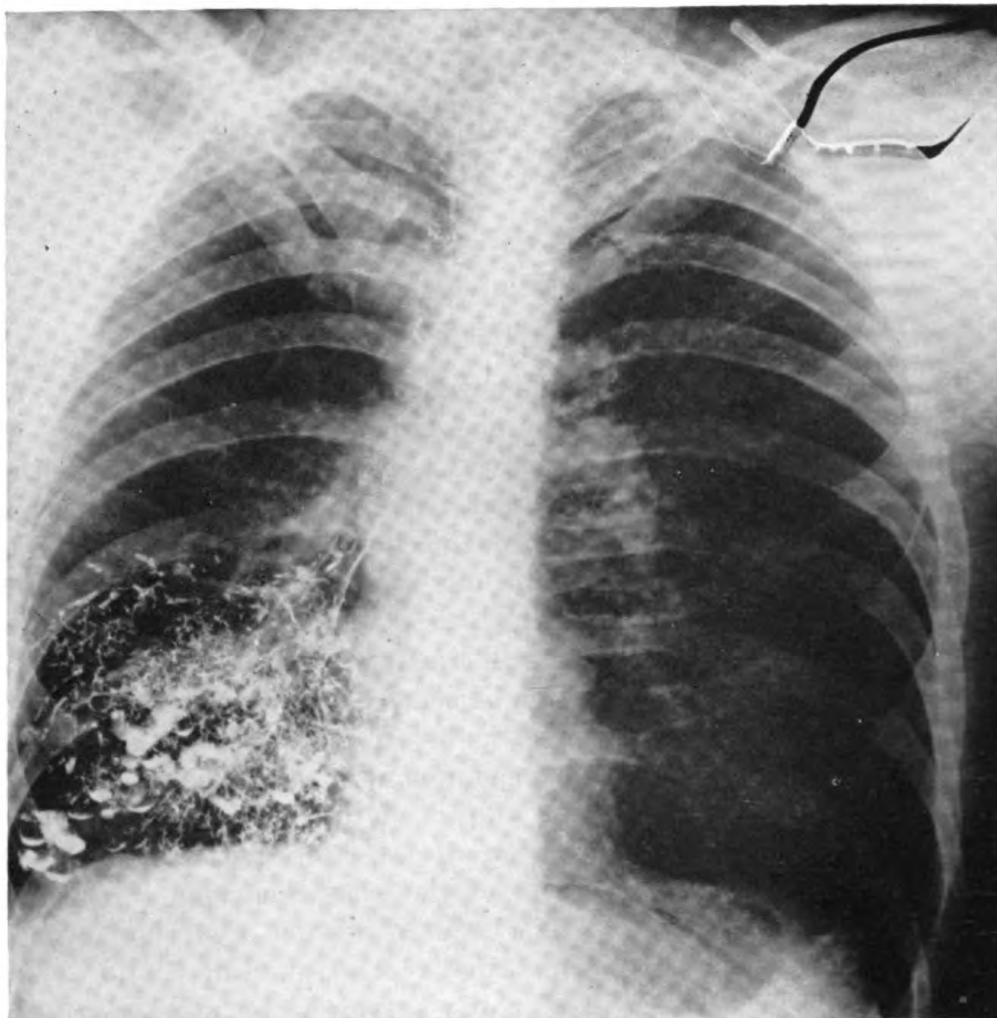
CYSTIC DISEASE OF THE LUNG

LEON SUSSMAN

Lieutenant Commander (MC) U. S. N. R.

The increased use of x-rays has disproved the so-called rarity of various pulmonary conditions, among them being cystic disease of the lung. Considerable confusion exists in the literature concerning this condition which has been variously termed by Koontz (1) "congenital bronchiolectasia, fetal bronchiectasis, congenital cystic disease of the lung, and honeycomb lung." That all these terms refer to the same condition is now generally accepted. The similarity in the pathological findings of a cyst wall lined with columnar epithelium, as well as the frequent association of other developmental abnormalities such as accessory lobes, diverticulae of the trachea and bronchi, and esophageal cysts speak for a common etiology. The relationship of these congenital cysts to the adult type of bronchiectasis is evidenced by the similar distribution of the lesions as explained by Koontz. He reported 50 percent of the cysts occurring in the left lung, 25 percent in the right lung, and 25 percent occurring in both lungs. The frequency of the abnormality was found by Gould (2) to be 1 in 18,400 in a routine mass x-ray survey of 442,252 apparently normal persons. This represented the sixteenth most frequent non-tuberculous abnormality.

The theories of the formation of the cysts were reviewed by Oughterson and Taffel (3), and resolve themselves almost exclusively in some form of bronchiolar obstruction, due to either distortion, infection, constriction or combinations thereof, as a result of external pressure or atelctasis. Thus their degree and distribution seem to be influenced by the number of constrictions, the presence of infection, the integrity of the mucosa, and the contents of the cysts. Various types have been described, their differences depending upon the existence of bronchiolar communication. The classification used by Norris and Landis is as follows: (1) Solitary or multiple balloon cysts with bronchial communication permitting ingress but not permitting egress of air; (2) solitary and multiple fluid cysts (nonexpansile) with no bronchiole communication; (3) and solitary and multiple nonexpansile air cysts with a free bronchial communication.



1. (Case 1.) Showing cystic distortion of bronchial tree after lipiodol instillation.

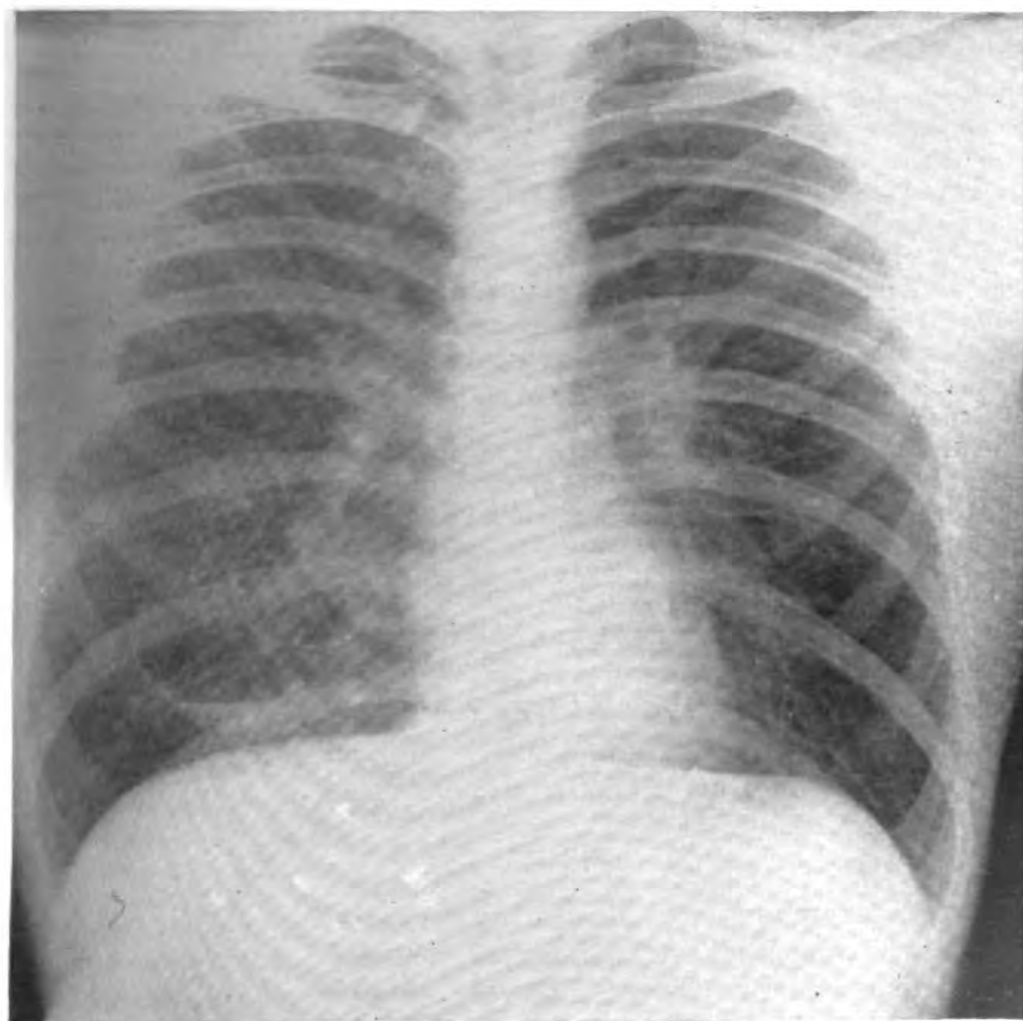
Three cases seen recently at this hospital present characteristics of this interesting group of intrapulmonary cysts.

CASE REPORTS

Case 1.—A 30-year-old yeoman, second class, was admitted with the complaint of chronic cough of several years duration, productive of 2 ounces of thick yellowish sputum which was occasionally blood streaked, and pain in the right lower chest of 1 year's duration. His past history revealed that for many years before enlistment he had had numerous attacks of pneumonia. A thoracotomy for empyema of the right lower chest had been done at the age of 4 years. For the past 3 years he had several "colds," accompanied by severe coughs. Physical examination revealed a thin adult with a slightly emphysematous chest. There was a thoracotomy scar of the lower right posterior chest. The only abnormal physical signs elicited were slight dullness and a few inconstant moist râles at both bases, more marked on the right. There

was no clubbing of the fingers. Laboratory data, including urinalysis, blood counts, blood Kahn, and sedimentation rates, were essentially normal. Frequent sputa examinations for acid-fast bacilli, fungi, and yeasts were negative. X-ray of the chest revealed the classical changes in illumination of cystic disease at the right base. Stereoscopic films showed the cystic appearance at the right base to lie well within the parenchyma of the lung, rather than superficially near the pleura. After lipiodol instillation (fig. 1) marked cystic distortion of the bronchial tree bilaterally was seen, with the greatest extent of the cystic changes at the right base.

This case represents the multiple nonexpansile air cysts mentioned before. The existence of the lesions since birth can be suspected by the history of repeated pulmonary infection since that time. The absence of signs of toxicity and clubbing speaks against the inflammatory type lesions seen in adult bronchiectasis.



2. (Case 2.) Showing three well defined cysts in right lower lung field with fluid level in lowest cyst.

Case 2.—A 22-year-old gunner's mate, second class, was admitted with the complaint of cough, productive of blood-streaked sputum for the past 6 months. There was no past history of respiratory diseases. Examination of the chest revealed numerous scattered moist râles, heard bilaterally. The patient produced considerable blood-streaked sputum. Laboratory examinations, including urinalysis, blood counts, blood Kahn, and sedimentation rates, were normal. Numerous sputum examinations for acid-fast bacilli, fungi, and yeasts were negative. X-ray of the chest revealed three well defined cysts approximately 5 cms. in diameter, in the right lower lung field. There was a fluid level in one cavity (fig. 2). Stereoscopic examination showed the cysts to lie in the lung parenchyma. Within a few days the fluid level disappeared, and the final examination merely revealed the presence of the three cysts in the lung. Re-examination of the 35-mm. induction x-ray of the chest revealed the same cystic changes that were noted during this illness.

This case represents the larger type of multiple nonexpansile air cyst with free bronchial communication. Respiratory infection in this instance probably produced a temporary blockage to the communication and caused fluid retention in the cyst.

Case 3.—A 42-year-old lieutenant commander was admitted with no complaints. The history as given was that he had been in good health all his life, except for rare attacks of "bronchitis." About 6 months before admission he had another attack of "bronchitis," associated with cough and slight loss of weight. During this attack he awoke suddenly one night in acute respiratory distress, with a sense of suffocation and severe stridor. X-ray films of the chest taken at that time were reported as revealing a partial pneumothorax on the left side. Subsequent x-ray films revealed essentially the same findings. Critical review of the films however revealed that there was no pneumothorax present, but that the entire upper half of the left chest was occupied by an immense air cyst. The left lung was compressed into the lower portion of the left thoracic cage. The condition has remained static during the entire period of observation. The patient at present has no respiratory symptoms or other evidence of decreased pulmonary reserve. He has remained on active duty, involving the climbing of ship's ladders and has no complaints.

This case represents the balloon type of air cyst. The acute attack of dyspnea was not a pneumothorax but more probably a rather sudden increase in the intracystic air pressure with resultant increase in the size of the cyst. This type is easily confused with emphysematous bullae, or bleb, as its large size displaces so much lung tissue that its intrapulmonary location cannot be demonstrated.

SUMMARY

Three cases are presented illustrating the variations in the condition described as congenital cystic disease of the lung. Attention is again invited to the more frequent discovery of a previously considered "rare" abnormality by means of mass x-ray study.

REFERENCES

1. KOONTZ, A. R. : Congenital cysts of lung. *Bull. Johns Hopkins Hosp.* **37**: 340-361, November 1925.
2. GOULD, D. M. : Nontuberculous lesions found in mass x-ray surveys. *J. A. M. A.* **127**: 753-756, March 31, 1945.
3. OUGHTERSON, A. W. and TAFFEL, M. : Pulmonary cysts; review of subjects, with case report. *Yale J. Biol. & Med.* **9**: 77-100, October 1936.



ACUTE NONSPECIFIC THYROIDITIS FOLLOWING MEASLES

REPORT OF A CASE

SAMUEL CANDEL

Lieutenant Commander (MC) U. S. N. R.

Acute inflammation of the thyroid gland is seen infrequently (1) (2) Clute and Smith (3) point out that Hagenbuch found 43 cases in 49,953 medical and surgical admissions to the Basle Clinic during a 10-year period. At this naval activity, acute thyroiditis was observed only once in 14,454 admissions. Nordland (4), however, states that the condition occurs more frequently than is supposed. Thompson (1) believes that the milder forms go unrecognized.

Case report.—An 18-year-old fireman was admitted on 16 January 1945 with fever and a history of cough for 3 days. His past history was noncontributory. Physical examination showed a moderately ill man with a temperature of 101° F. and a faint, morbilliform eruption on the face, body, and extremities. There were numerous Koplik's spots on the buccal mucosa. A white blood cell count was 5,550 with 70 percent polymorphonuclear cells, 28 percent lymphocytes, and 2 percent monocytes. The urine was normal. The rash became most pronounced on 19 January. On 20 January the temperature, which had varied from 101° to 104° F., came down to a normal level and remained so until 26 January. On 22 January blood Kahn was negative and the erythrocyte sedimentation rate was 24 mm. per hour (Cutler). Cough persisted and rales were audible at the left base. Roentgenogram of the chest showed no evidence of pulmonary infiltration.

On 26 January the man had no complaints but his oral temperature rose to 99.2° F. after it had been normal for 6 days. The next day he had slight difficulty and pain on swallowing but made no complaint. On 29 January dysphagia and pain became marked. Temperature was 102° F.; pulse 92; respiration 20. Physical examination revealed no inflammatory lesion of the pharynx. There was marked fullness of the lower neck. The suprasternal fossa was obliterated. There was marked tenderness of the isthmus and both lobes of the thyroid gland which was readily palpable. There was no tenderness of the sternocleidomastoid muscles or of the overlying skin. No cervical adenopathy or parotitis was present. A complete blood count showed W. B. C. 14,300 with 79 percent polymorphonuclear

cells, 19 percent lymphocytes and 2 percent monocytes; R. B. C. 4,310,000; Hb. 14.0 grams. Blood cholesterol was 140 mg. percent. Erythrocyte sedimentation rate was 26 mm. per hour (Cutler). The urine was normal. All other physical findings were negative.

In view of the findings mentioned, a diagnosis of acute thyroiditis was made. An ice bag was applied to the thyroid region and sedatives were given. On 30 January temperature was 102° F., and fullness of the lower neck had increased. There was less dysphagia. On 31 January he was given full doses of sulfadiazine. On 1 February temperature was 101.2° F. The patient complained of only a little pain on swallowing. The thyroid isthmus was swollen and tender. The lower pole of the left thyroid lobe was tender. The right lobe was no longer tender. On 2 February temperature was 101° F., and he complained of a little more pain on swallowing. The isthmus of the thyroid was less swollen. The lower pole of the left thyroid lobe was still tender. On 3 February the patient had much less pain and only slight dysphagia. The isthmus and the left thyroid lobe were less tender. Temperature was 99°. On 5 February the temperature was normal. Swelling of the neck had decreased considerably. The thyroid gland was not tender. W. B. C. was 8,700 with 60 percent polymorphonuclear leukocytes, 34 percent lymphocytes; 6 percent eosinophils. He remained afebrile and on 8 February sulfadiazine was discontinued. A basal metabolic rate done on 11 February was minus 26.

COMMENT

Inflammatory conditions of the thyroid gland have been divided into two groups: (1) Specific, such as those due to tuberculosis, syphilis, actinomycosis, echinococcus; (2) nonspecific, which are further subdivided into (a) the acute form with or without abscess formation and (b) the chronic form (5). The literature is clear about all forms but the chronic nonspecific variety. In the latter category some authors have placed Riedel's struma and struma lymphomatosa (Hashimoto) (6) (1). Kearns (7) considers the problem of chronic, nonspecific thyroiditis to still be very confusing and emphasizes that clinically, Riedel's struma and struma lymphomatosa seem to have little or no relation to any definite previous acute inflammatory lesion. It appears advisable, for the present, to restrict the term chronic, nonspecific thyroiditis to such cases, referred to by Davis and Howell (8), which originate as an acute process and neither subside completely nor suppurate but which persist for months.

Acute thyroiditis may occur during or after acute infections such as those of the upper respiratory tract, abscessed teeth (5), pneumonia typhoid fever, rheumatic fever (8), malaria (9), pelvic cellulitis post partum (10), measles, mumps, diphtheria, and scarlet fever (2) (3) (11). According to Rea (2), thyroiditis following epidemics has been reported by Denime and Brisson. At the Mayo Clinic, it was found that suppuration occurred (8) in approximately one-third of the cases of thyroiditis. On the other hand, Clute and Smith

state that abscess formation is rare. Streptococci, staphylococci, pneumococci, *B. typhosus*, and *B. coli* have been obtained from abscess of the thyroid gland (12). A thyroid gland which has undergone previous pathologic change is said to be more susceptible to infection (13). However, thyroiditis may occur in an apparently normal thyroid (3). Thyroiditis secondary to mumps, measles, diphtheria, and scarlet fever usually disappears without suppuration (3).

Invasion of the thyroid gland takes place most commonly by the way of the blood stream. Rarely it may proceed through direct extension by way of a persistent thyroglossal duct (Meeker's case; Stein's case) (14). The anatomical position of the normal thyroid gland, which is situated deep in the neck and is covered by muscles and fascia, is such that direct extension from infections of the oral cavity or overlying skin is most difficult (14). The numerous coverings of fascia, which surround the gland, are thought to be responsible for the pain resulting from inflammation because they prevent rapid distension of the gland. Increased intrafascial tension is likewise considered an important factor in producing dyspnea or dysphagia (15).

According to Cochrane and Nowak (16), Bauchet's monograph, published in 1857, which recorded five cases of acute thyroiditis, gave a classic description of the disease to which very little has been added. Bauchet described a characteristic attitude of the patient who maintains his head in gentle, forward flexion towards his sternum in order to relax the subhyoid muscles. Bauchet pointed out that the tumefaction obliterates the hollow formed by the junction of the two sternomastoid muscles and that the tumefaction follows the movements upward and downward of the larynx. He found that the thyroiditis lasts, in general, from 1 to 2 weeks and that the tumor appears on the second or third day and enlarges from the third to the sixth day. If suppuration did not follow, the swelling diminished and disappeared on the fifteenth to twentieth day. If the gland showed a tendency to suppurate, the constitutional symptoms became worse and locally the skin became tense, red, painful, and showed fluctuation. Bauchet emphasized that spread of the abscess outside of the thyroid gland was serious and almost always fatal since the pus would follow the trachea, vessels of the neck, and reach as far as the anterior or posterior mediastinum. However, Kocher (Rhea (3)) found that suppurative thyroiditis is more likely to rupture externally with the formation of a fistula. Davis and Howell (8) are of the same opinion. Nevertheless, if the abscess ruptures into the esophagus, trachea, or mediastinum, the conditions becomes dangerous, often fatal (13).

Burhans (14) has listed the following as symptoms and signs of thyroiditis:

1. Pain over thyroid gland.
2. Swelling of the thyroid gland or an adenoma of the thyroid.
3. Tenderness over the thyroid.
4. Chills and fever.
5. Coughing.
6. Dyspnea.
7. Hoarseness and asphonia.
8. Dysphagia.
9. Thyrotoxicosis.

In case abscess formation occurs:

10. Fluctuation in the tumor.
11. Redness of the overlying skin.

It has been reported that at some period during the acute phase, evidences of low grade hyperthyroidism may appear with a basal metabolic rate as high as plus 30 (5). The end result of thyroiditis is usually hypothyroidism, the extent of which is related to the amount of gland destroyed (2).

The conditions which must be differentiated from acute thyroiditis are: (a) Cellulitis of the neck; (b) Ludwig's angina; (c) diphtheritic laryngitis; (d) perichondritis of the thyroid cartilage; (e) physiologic hypertrophy of the gland; (f) spontaneous hemorrhage into the thyroid; (g) glossitis; (h) branchial or thyroglossal cyst; (i) malignancy; and (j) tuberculosis or syphilis of the thyroid gland (13) (14).

Treatment of the nonsuppurative variety is symptomatic and of the suppurative variety of acute thyroiditis, surgical drainage as soon as the diagnosis is made.

REFERENCES

1. THOMPSON, W. O.: Thyroid dysfunctions and their treatment. *J. A. M. A.* 117: 441-450, August 9, 1941.
2. REA, C. E.: Staff Meeting Bulletin—Hospitals of the University of Minnesota. November 12, 1937. No. 7. p. 85-90.
3. CLUTE, H. M. and SMITH, L. W.: Acute thyroiditis. *Surg., Gynec. & Obst.* 44: 23-29, January 1927.
4. NORDLAND, M.: Thyroiditis. *Minnesota Med.* 20: 218-222, April 1937.
5. YOUNG, T. O.: Inflammatory disease of thyroid gland. *Minnesota Med.* 23: 105-111, February 1944.
6. MCCLINTOCK, J. C. and WRIGHT, A. W.: Riedel's struma and struma lymphomatosa (Hashimoto); comparative study. *Ann. Surg.* 106: 11-32, July 1937.
7. KEARNS, J. E., JR.: Struma lymphomatosa (Hashimoto); report of 2 cases. *Ann. Surg.* 112: 421-425, September 1940.
8. DAVIS, A. C. and HOWELL, L. P.: Medical management of diseases of thyroid gland. *M. Clin. North America* 24: 991-1018, July 1940.

9. SEIN, M.: Acute non-suppurative thyroiditis. *Lancet* 2: 673, September 17, 1938.
10. WAHRSINGER, P. B.: Acute thyroiditis complicating puerperium. *Am. J. Obst. & Gynec.* 28: 281-282, August 1934.
11. JENSEN, D. R.: Acute thyroiditis complicating scarlet fever. *Am. J. Surg.* 60: 301-303, May 1943.
12. WEINSTEIN, M. L.: Acute suppurative thyroiditis with report of one case. *Illinois M. J.* 63: 275-278, March 1933.
13. KLOSE, H.: The Acute Inflammations of the Thyroid; Their Etiology, Course and Surgical Treatment. *Internat. Abstr. Surg.* 31: 444-445, 1920. Abstracted from *Klin. Wehnschr.* 57: 202, 1920.
14. BURHANS, E. C.: Acute thyroiditis; study of 67 cases. *Surg., Gynec. & Obst.* 47: 478-488, October 1928.
15. ROGERS, L.: Suppurative thyroiditis; 2 cases. *Lancet* 1: 868-869, April 23, 1927.
16. COCHRANE, R. C. and NOWAK, S. J. G.: Acute thyroiditis with report of 10 cases. *New England J. Med.* 210: 935-942, May 3, 1934.



PENICILLIN IN TREATMENT OF FULMINATING GENERAL PERITONITIS

REPORT OF A CONFIRMED CASE

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and

F. GREGG THOMPSON, JR.

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General peritonitis following perforation in appendicitis formerly carried a high mortality rate, and is still the cause of many deaths yearly, even in large medical centers.

The lowering of this mortality is not attributal to any one therapeutic measure but is the result of several important and definite procedures evolved over a period of years.

These may be listed and summarized as: (1) Early diagnosis of appendicitis with prompt surgical removal or prophylactic appendectomy between attacks; (2) intelligent gentle handling of the gangrenous walled-off appendix without contaminating the general peritoneal cavity; even leaving the appendix alone under circumstances involving undue trauma to effect removal; (3) establishment of adequate pelvic and lumbar gutter drainage; (4) balancing the patient's body fluid, electrolyte, and protein need by wise intravenous therapy; (5) controlled decompression of the distended intestinal tract by

siphon suction of Wangenstein; (6) the use of chemotherapeutic sulfa drugs; and (7) the use of penicillin, the most recent addition to our multiple and effective procedures.

There have been a few proved cases of general peritonitis, following appendicitis and treated with penicillin, reported in the literature. Fauley *et al.*,¹ of the Naval Medical Research Institute, were able to demonstrate that adequate amounts of penicillin were remarkably effective in the treatment of experimentally-induced peritonitis in animals. They produced gangrene of the appendix and a fulminating diffuse peritonitis by ligating the appendical base including the blood vessels in the mesentery of the appendix; and added insult to injury by placing 50 cc. of castor oil in the stomach through a tube following operation. All the animals (20) survived when penicillin treatment was begun 1 hour following operation. Where treatment with penicillin was begun 12 hours following operation 15 out of 19 animals so treated survived. Craig *et al.*,² members of the Penicillin Committee of the National Naval Medical Center, reported seven cases, but did not state whether the peritonitis was localized or generalized and fulminating in character. The 7 cases were in a series of 1,455 cases of various infections treated with penicillin.

Surgical operation has nothing to offer in the actual treatment of fulminating general peritonitis, and fortunately has practically disappeared; as its use only hurried the unfortunate victim to an untimely death.

There are good reports in the literature from the use of the old Ochsner form of treatment, and it was undoubtedly better than surgical intervention with attempted drainage in general fulminating peritonitis. It is our opinion, however, that the case reported here was definitely becoming moribund under such a regimen for the 4 days prior to admission to this hospital.

Penicillin therapy alone apparently will not cause resolution of pus collections but it will check or lessen the spread of pyogenic infection thereby permitting surgical drainage at a later date when the patient's general condition has improved and the surgical risk has been reduced to a minimum.

Case report.—The patient, a 50-year old veteran, was admitted to the hospital in critical condition. His pulse was 148, temperature 104°, and respiration 24. His present illness began 4 days before admission to the hospital with an onset of generalized abdominal cramps accompanied by nausea. He called a retired

¹ FAULEY, G. B., DUGGAN, T. L., STORMONT, R. T., and PFEIFFER, C. C.: Use of penicillin in treatment of peritonitis; an experimental study. *J. A. M. A.* 126: 1132-1134 December 30, 1944.

² Penicillin Committee, National Naval Medical Center (Craig, W. M., et al.): Penicillin; progress report. *U. S. Nav. M. Bull.* 44: 453-479, March 1945.

physician who gave him a hypodermic of morphine which relieved the pain. He did not vomit. He took milk of magnesia and had a bowel movement that night but none for the past 3 days since. He remained in bed at rest and was given calomel and several hypodermics each day for 2 days before admission to the hospital. His abdomen gradually became distended and hard. Severe pain in the abdomen would recur between hypodermics of morphine. He only sipped liquids by mouth.

Physical examination on admission revealed a critically ill man with typical peritoneal facies, obviously dehydrated, with acetone breath and rapid, bounding pulse. Blood pressure was 100/70. Heart and lungs were essentially normal. The abdomen was markedly distended and tense. It was of boardlike rigidity throughout. There was equal tenderness in all quadrants. No masses could be palpated. Auscultation with the stethoscope revealed no sounds of peristalsis.

Laboratory reports revealed a W. B. C. of 12,350 with 86 percent segmented cells, hematocrit 35, blood chlorides 247 mg. per 100 cc., and CO₂-combining power 70 percent.

The patient was given 1,000 cc. of 5 percent dextrose in physiologic saline solution every 8 hours, 500 cc. of whole blood 2 hours after admission, and 40,000 units of sodium penicillin every 3 hours. Siphon suction by Wangenstein method was instituted, and nothing by mouth allowed.

He ran a rather stormy course for 7 days during which time he developed a patchy consolidation at the base of the left lung confirmed by x-ray examination. By the tenth day, however, his pulse and temperature were normal, the abdomen was flat, and the bowels moved normally.

The penicillin was discontinued on the eleventh day after admission; during that time he had received a total of 2,620,000 units.

On the seventeenth day after admission he began to run a temperature of 100° to 102° F. and complained of pains in the lower midabdomen. Examination revealed tenderness in right lower quadrant but there was no rigidity and little spasm.

On the twenty-first day after admission a laparotomy was performed through a right rectus incision. On opening the peritoneum numerous light fibrinous adhesions were found covering the loops of the small bowel. Palpation of the gallbladder showed it to be thin walled, without stones, and to empty easily. The rest of the abdomen was negative to palpation except the appendix. A small mass was found behind the cecum which proved to be an abscess containing a perforated appendix and about 40 cc. of yellow purulent exudate. Smears showed numerous pus cells, numerous gram-positive cocci singly, in pairs, and in short chains, some gram-negative bacilli, and a few gram-positive diphtheroids. From cultures were reported: (1) *Streptococcus anereobius*, (2) *Proteus vulgaris*, (3) an organism of the family Micrococcaceae, genus 1, micrococcus. The appendix was removed and a Penrose drain was placed in the abscess cavity with 5 grams of sulfanilamide powder, and brought out through a stab wound in the McBurney area. Right rectus wound was closed entirely.

The patient made an uneventful convalescence following the operation.

CONCLUSIONS

A fulminating case of general peritonitis following acute appendicitis with perforation has been successfully treated with penicillin plus suction siphonage and supportive intravenous therapy.

A localized appendiceal abscess was not resolved by the stated treatment, but apparently was rendered innocuous and amenable to later successful surgical drainage.

The surgical pathology was definitely confirmed by laparotomy.



INSTRUCTIONS FOR PROSTHETIC PATIENTS

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It is regrettable that the insertion of dentures in the mouth of the average dental patient is treated lightly in so many cases. Too often the dental officer inserts the dentures and dismisses the patient with a cheery good-bye after merely telling him to try them out for a few days and return when he gets some sore spots.

The patient must be instructed as to the best way to proceed with mastering the dentures, what to expect from them, and how to care for them. Sometimes we fail to realize that what is common knowledge to the dental officer is confusing to the patient. Some dental officers may not be sure just what information should be given the patient. Sometimes because of the constant pressure of work, and having other patients waiting, he fails to pass along the necessary advice to the patient with newly completed dentures. Whatever the case, the result is the same—the patient has little idea what to expect and may become discouraged. The dentures may fail simply because the patient was not given sufficient advice. Some patients will stumble around and learn, by taking advantage of their errors and mistakes, to wear the dentures. Others possibly will give up completely and never master them. Many patients who have worn dentures for some time have never derived the full benefit from them due to the improper approach in mastering them.

While correct verbal instructions are fine for a few patients, they are generally insufficient as to complete details. These verbal instructions are usually given while the patient is under the strain of just having received the new teeth and is unlikely to remember the instructions, no matter how well they are given. At this clinic we have solved the problem by having all the pertinent data and instructions printed in a folder and each patient given a copy at the same sitting the dentures are inserted. He may read and study it at his leisure and keep it for reference in the event some problem arises concerning the dentures and their care or handling.

FACTS AND SUGGESTIONS CONCERNING YOUR DENTURES

DENTAL PROSTHETIC DEPARTMENT, NAVAL TRAINING STATION,
NORFOLK, VA.

Although the dentures you have just received may not be your first set, the following facts and suggestions as to their care, use, and expectancy will be of value to you.

The success you may expect to have with them is dependent upon many factors. Most important of these are the conditions which you present to the dental officer, such as the size and shape of your mouth, your temperament and general health, and whether or not you really want to wear the dentures. These teeth are made by a highly specialized dental officer, and are fabricated of the finest materials available. Even so, the success of your case depends on the cooperation you give him.

In general, your questions and problems will pertain to the esthetics (or appearance) of your case, your speech, your ability to eat with them, and how to care for both the dentures and your mouth.

When the dentures are placed in your mouth, you will immediately be conscious of their bulk. Their actual size and the crowding of the tongue seem exaggerated because your tongue is accustomed to the additional room present in your mouth, after the loss of your natural teeth. Your lips may seem strained and full due to the border of the denture under them. This awkward feeling will disappear and your lips will relax and assume their normal appearance as soon as they become accustomed to the denture being under them. You must also remember that, while you were possibly not aware of it, your appearance has changed due to the loss of your teeth. Very likely your lips have sagged a little, your cheeks hollowed some, and your chin moved a little closer to your nose. When these conditions are removed suddenly by the insertion of dentures, your appearance may seem unnatural at first, but this impression will rapidly disappear.

Some difficulty may be expected in speaking. It is simply a matter of practice. If you will spend an hour or two reading a paper or book aloud, great strides will be made in mastering it. Be careful to talk slowly and clearly. Try to enunciate each word carefully and you will soon be talking as distinctly as before.

Eating is a little more difficult to master. While the upper denture will stay up regardless of the position of your tongue, success in handling the lower denture is entirely dependent upon its position. Your tongue should be kept level with the top of the lower teeth at all times. Never let it lie on the floor of the mouth. Its tip should be held lightly against the inner surface of the lower front teeth. If you fail to keep your tongue in this position, food will get under it, and also between it and your denture. Then, in attempting to push the food back between your teeth, the denture may be loosened. Remember this—**ALWAYS KEEP YOUR TONGUE AT LEAST AS HIGH AS YOUR LOWER TEETH AND THE TIP OF IT TOUCHING THE FRONT TEETH.** Begin with small bites and stick to soft foods. After you become thoroughly accustomed to the dentures, bites of normal size may be handled. Do not expect to be able to eat with them immediately. If you can expertly handle all ordinary foods at the end of the first month, you are doing exceptionally well.

Remove the dentures after each meal and rinse them thoroughly. Use a brush on the teeth and the area around them, but do not scrub the bearing surface, i. e., the surface which fits against the tissues of your jaw. Scrubbing

this surface would eventually wear it away and affect the fit of your denture. Although many people prefer to wear them day and night, it is recommended that you leave your dentures out at night to give the mouth tissues a chance to rest and regain their normal tone. When this is done, or at any time when the dentures are to remain out of your mouth, put them in a glass of water to which a little salt, soda, or mouth wash has been added.

In a day or two, and from time to time thereafter, you may develop sore spots in your mouth. Likewise, if there are any clasps on the dentures, they may loosen and require tightening. When either of these conditions arises, consult the nearest dental officer immediately. NEVER attempt to correct or adjust the dentures yourself.

A great part in the successful wearing of dentures depends on your cooperation. If you make an honest effort, you will quickly master them. It's up to you. **WE MAKE THEM—BUT YOU WEAR THEM!**



REPLACEMENT OF MISSING TEETH OF ACRYLIC DENTURES IN THE FIELD

HOWARD J. CURRY

Lieutenant (DC) U.S.N.R.

The dental officer in the field is often confronted with the problem of repairing broken dentures that have one or more missing teeth in addition to the fracture of the body of the denture. The standard Navy prosthetics repair unit for the field is not equipped with teeth for replacements. Fortunately, before leaving for our present assignment, we added to our list of supplies all the available shades of tooth acrylic. This enabled us to make our own teeth and proved to be a simple and efficient procedure. We found that if properly handled the resulting esthetics were exceptionally good and that the acrylic used for teeth did not intermingle with the basic pink acrylic. Also, when the two shades of acrylic are cured together they form a continuous mass which adds to the strength of the repaired denture.

TECHNIQUE

The desired shade is selected for the acrylic tooth or teeth. The denture is placed in the mouth and fitted together. The two halves are secured with a wooden matchstick and a few drops of sticky wax across the occlusal surface. A cast is made of plaster of paris. Using a cross-cut fissure bur the pink material is cut away from the fractured

area about 2 mm. on both sides. It is best to cut a step in the preparation or make dovetails to add strength to the repaired area. If it is possible to remove the denture from the cast, the ridge should be tin-foiled or a good separating media painted on the cast. A wax pattern is carved into the space of the missing tooth and the preparation of the denture waxed up. Many times the missing tooth will not be in the same area as the denture fracture. This is advantageous in that not so much care is necessary in the packing and curing process. The case is then ready for investing in the lower half of the flask.

The plaster should cover all the denture except for the waxed portion. Upon setting, a smooth glaze of separating media is applied to the plaster and the upper half of the flask poured up with plaster of paris. The flask is placed in hot water to allow the wax to soften. The two halves are separated. Using a water syringe and boiling water, the remainder of the wax is flushed out. A thin glaze of separating media is applied to the plaster impression. The pink acrylic is mixed first according to the directions supplied with it. This material is packed and trial-packed several times, each time cutting away the excess material. The pink material is allowed to stand several minutes and partially cure before mixing the tooth acrylic. This helps to prevent the two shades intermingling during the curing process. The tooth acrylic is trial-packed several times and before closing the flask for the curing, all excess material is carefully eliminated. A moist piece of cellophane is placed over the packed acrylic and the flask closed tightly under pressure. The case is processed for one-half hour at a temperature of 158° F. and then allowed to boil for one-half hour. The case is allowed to bench-cool before opening. The investment is chipped away and the case cleaned with a stiff brush. Polishing is done with finishing burs, rubber polishing cups and fine pumice and whiting.

CONCLUSION

This technic offers an answer to the problem of replacing teeth of broken dentures in the field. The case is nice looking. It is easy to grind the acrylic tooth into occlusion. The acrylic replacement can be considered permanent.

INFARCT OF TESTICLE

REPORT OF A CASE

KENNETH P. KNUDTSON

Lieutenant Commander (MC) U. S. N.

The case to be reported is of interest because of the rare occurrence of infarcts of the testicle secondary to factors other than torsion. Cedermarck (1) reviewed 34 reported cases in 1936 and added 2 of his own. The following report involved an infarction of the testicle which was produced by thrombosis of the left pampiniform plexus following a varicocelectomy.

CASE REPORT

Case history.—A white male, 19 years of age, entered a United States naval hospital 20 January 1945 complaining of constant pain in the left testicle radiating to the left lower quadrant for the past 4 months. In October 1944 the patient had a left varicocelectomy aboard an evacuation transport following symptoms of pain in the left testicle on standing or exertion during the preceding 6 months. Since the time of operation the patient had had constant severe pain radiating to the left lower quadrant which became excruciating after prolonged standing or exertion. He had noted that the left cord was thick and hard as it lay in the scrotum. The past history and family history were noncontributory.

Physical examination revealed a healthy male, not acutely ill with normal temperature, pulse, and respirations. The findings of general examination were not remarkable except that a massive hard thrombosis of the left pampiniform plexus could be palpated and the left testicle was atrophied. The laboratory findings were within normal limits.

Operation.—On 1 January 1945 under procaine spinal anesthesia, a left orchidectomy was performed. The spermatic artery and cord were ligated and divided below the internal inguinal ring. The recovery was uneventful.

Pathology.—The specimen (see figure) consists of a left testicle 6 by 3.5 by 2.5 cm. with epididymis and a portion of the vas deferens attached. The cut surface reveals a brown-yellow discoloration of the parenchyma with infarction of the entire testicle. Microscopic sections shows necrosis of the seminiferous tubules and stromal



Left testicle cut in half showing infarction of one entire testicle

cells. The pampiniform plexus is thrombosed and the thrombus has undergone organization. There is engorgement of the veins and hemorrhagic infiltration and deposits of hemosiderin in the intertubular connective tissue.

To visualize an infarct of the testicle it is imperative that the blood supply be understood. The internal spermatic artery arises directly from the abdominal aorta and is the principal artery of the testis. The internal spermatic artery anastomoses freely and in various ways with the deferential and cremasteric arteries. The veins accompany the arteries and as they emerge from the testicle and epididymis, form the pampiniform plexus. The arteries of the testis are regarded as end arteries by Miflet (2) and Lubash (3), but Colle (4) estimates that this is true in only 7 percent of the cases. Griffiths (5) reported an experimental case in which ligation of both the internal spermatic artery and veins produced no atrophy of the testicle which is in support of Colle's contention.

A review of the reported cases of infarct of the testicle due to causes other than torsion by Menville (6) shows that 68 percent occurred between the ages of 10 and 30 years; the age range was from 5 to 64 years. The lesion occurred on the left side in 60 percent of the cases.

SUMMARY

A case report of infarct of the testicle produced by thrombosis of the pampiniform plexus is presented. The thrombosis and subsequent infarction occurred following varicocelelectomy.

REFERENCES

1. CEDERMARK, J.: Infarction of testis. *Acta chir. Scandinav.* 78: 447-491, 1936.
2. MIFLET, J.: Ueber die pathologischen veränderungen des hodens, welche durch störungen der lokalen blutcirculation veranlasst werden. *Arch. f. klin. Chir.* 24: 309-428, 1879.
3. LUBASH, S.: Infarction of testicle. *J. Urol.* 18: 421-425, October 1927.
4. COLLE, J. F. E.: Arteres du testicule. Demonstration d'une anastomose funicule-spermatico-deferentielle; son rôle apres la section totale du cordon. These de Lille, No. 75, 1902. Cited by Lehman: Inaug. diss. Leipzig, 1906 (Cedermark).
5. GRIFFITHS, J.: The effects upon the testes of ligation of the spermatic artery, spermatic veins, and of both artery and veins. *J. Anat. and Physiol.* 30: 81-105, October 1895.
6. MENVILLE, J. G.: Infarct of the testicle. *J. Urol.* 43: 333-338, February 1940.



PENICILLIN IN ACUTE APPENDICITIS

REPORT OF A CASE

ELMER F. LOWRY, JR.

Lieutenant, junior grade (MC) U. S. N. R.

A case of acute appendicitis occurring at sea on board an APD without access to suitable operating facilities was treated with penicillin.

Case history.—On 11 January 1945 a 23-year-old chief electrician's mate experienced the sudden onset of moderately severe, generalized, colicky, abdominal pain, followed after 30 minutes to 1 hour by a brief episode of vomiting. Recently eaten food, allegedly unmixed with blood or other unexpected material was vomited. After from 10 to 12 hours the pain became less severe and localized in the right lower quadrant. The patient complained of moderate malaise and anorexia, and felt slightly feverish, but had no chills or urinary or other symptoms.

Past history and family history were noncontributory except that this was the patient's first attack of this kind.

Physical examination.—Rectal temperature 100.6° F., pulse 80, respiration 16, and blood pressure 110/75. The patient was a well-developed and well-nourished male in slight distress, moderately dehydrated. The physical examination was otherwise within normal limits except for the abdomen, where there was tenderness over McBurney's point, with cough and rebound tenderness referred thereto. Peristalsis was much diminished generally and could not be heard in the right lower quadrant. On rectal examination definite, consistent, and specific tenderness was elicited high on the right, but otherwise no abnormality was discovered.

Laboratory findings.—Urine was normal. White blood cells 16,500 per cm. of blood, with 98 percent polymorphonuclears.

Subsequent course and treatment.—The patient was given 1,000 cc. of 5-percent dextrose in saline intravenously, followed by 500 cc. of plasma. Twelve hours after the onset of the first symptoms the rectal temperature was the same at 100.6°, the white count was 19,000 and the patient felt no better. At this time intramuscular penicillin was begun, 10,000 Oxford units per hour to maintain an effective drug blood level.

Ten hours after penicillin therapy was begun the patient was subjectively much improved. He had had no bowel movement, but was passing flatus and was able to take a liquid and soft-solid diet. Peristalsis was slightly increased. Abdominal pain and tenderness were at last described but definitely decreased. Rectal temperature was 99.8° F., W. B. C. 9,000.

At this point, 100,000 units of penicillin having been given, the dosage was decreased to 10,000 units every 2 hours. This regime was continued until 200,000 units more had been given, over a period of 40 hours. At the end of that time the patient was transferred to a shore hospital where appendectomy was performed the following day.

COMMENT

After the first 10 hours of treatment the temperature and white count remained normal, and subjective improvement was steady,

though slow. The patient never felt or appeared very sick. Peristalsis gained slowly in vigor, and he continued to pass some flatus, but had no bowel movement. Nutrition and hydration were well maintained orally.

At operation the appendix was found to be free-lying, with disease evidenced only by slight reddening and edema. The pathological report is incomplete, but grossly the appendix was filled with purulent material which was cultured but grew out nothing. The culture media and technic used are not known.

Statistically and scientifically the present study leaves much to be desired, but emphasizes a relatively new approach to a classical surgical problem. The use of penicillin as a substitute for surgery is not advised; but in the circumstances in which it was used, it appears to be a reasonable temporizing measure, with more to offer than an operation at sea on a small ship, without adequate facilities or personnel for an intra-abdominal procedure.

Undoubtedly cases treated early will respond the best. If improvement under penicillin therapy is going to take place it will probably be prompt and rapid; and, if there is no improvement, immediate operation, if at all practicable, seems indicated.

In the case reported, the evidence of disease in the appendix together with the patient's afebrile course and general good condition strongly suggests the efficacy of the drug in controlling infection.



A CASE OF PENICILLIN DERMATITIS

Author's comment.—The inactive penicillin solution can have contained only manufacturing impurities and the breakdown products of penicillin. The fresh solution which produced the positive patch differed only in that penicillin was present. It can legitimately be concluded, therefore, that the etiological agent in the production of the dermatitis was penicillin and not its impurities. It is probable that sensitivity had been induced in the patient by the course of penicillin 25 days previously. A curious feature is that the conjunctivitis was not aggravated by the dermatitis-producing agent. Penicillin, supplied in 100,000-unit ampules, was used throughout.

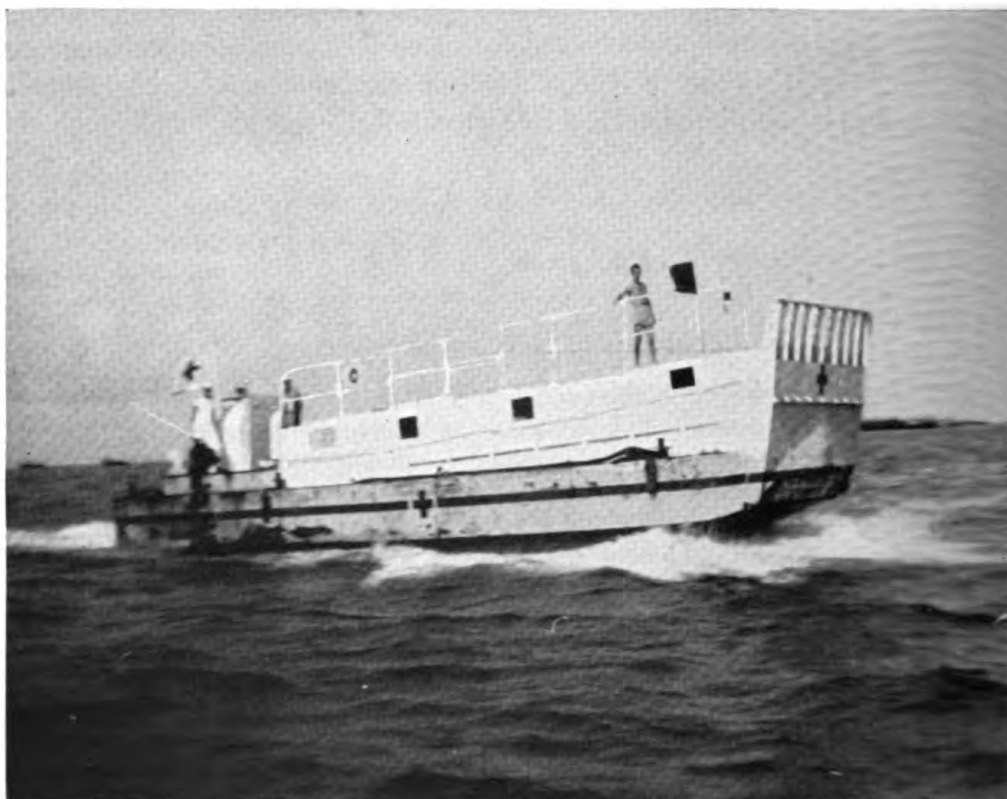
The haphazard use of penicillin-containing face powders and toilet applications envisaged in the popular press would appear to be not devoid of risk.—BEDFORD, P. D.: Case of penicillin dermatitis. *Brit. M. J.*, No. 4436, 51-52, January 12, 1946.

MEDICAL AND SURGICAL DEVICES

THE AMBULANCE BOAT

FREDERICK E. LANE
Lieutenant Commander (MC) U. S. N. R.

One of the great problems which confronted the Medical Department of the Navy during the war was the transfer of patients between ships, from ship to shore, and vice versa. Under battle conditions, all types of boats were employed, including LCVP's, DUK's and LCM's. These all had one fault in common, namely, lack of protection for the patient against the weather. At the various beachheads, little could be done



Official U. S. Navy Photo

An LCM converted to an ambulance boat.

about this, since it was necessary to employ the same boats which had brought our troops and supplies ashore.

In the rear areas, however, a satisfactory solution was found. LCM's were converted to ambulance boats containing bunks for 24 litter patients and sufficient space to carry an additional 75 ambulatory patients. The early model which was provided with a canvas cover was not satisfactory because it was not completely watertight and because ventilation was inadequate.

The latest models, which were converted by Service Squadron 102 at Eniwetok proved highly satisfactory. The cabin, which is built over the well deck is made of angle irons and plywood sufficiently strong to support over 100 people. It is completely watertight and plexiglass windows provide adequate light and ventilation. The deck over the cabin makes an excellent landing platform which facilitates transfer to and from ships in rough waters. The LCM has several advantages which are worthy of note. Its shallow draft and general construction make it possible to travel in places where it would be dangerous to operate other types of boats such as motor launches, picket, or crash boats. The twin engines add a safety factor in case of failure of one engine. Its speed (10 knots) is sufficient for most emergencies. The landing ramp makes it possible to land upon a beach for discharge or reception of patients. The all-metal construction of the hull reduces hull-maintenance problems to a minimum. Its great weight (approximately 30 tons converted) results in a stability which is highly desirable. Nevertheless, it is still possible to take the ambulance boat aboard ship for transportation from one location to another. The 35-ton jumbo boom which is employed for handling LCM's is perfectly satisfactory. The regulation LCM sling requires only the addition of a "spreader" to adapt it for lifting the ambulance boat.

Overhead electric lights give sufficient illumination for work at night. A signal light and a two-way "walkie-talkie" type radio provide communication with ships and shore stations.

The crew consists of a coxswain, an engineer, a bowman, a sternman, a signalman, and a pharmacist's mate qualified for independent duty. The medical complement is augmented with other pharmacist's mates or medical officers as the situation requires.

The ambulance boat is equipped for first-aid treatment, and carries wood, wire, and Thomas-type splints, drugs for emergency therapy, intravenous solutions, plasma, and even whole blood. It can also be set up for minor, and if necessary, major surgical procedures.

One such ambulance boat, which has been operating in the Pacific, has transported over 1,000 patients without mishap and has had many interesting experience. On several occasions, while located in the

Eniwetok Atoll, messages were received from ships such as LSM's or LCI's traveling in convoy, requesting transfer of urgent cases. Rendezvous were arranged and the ambulance boat met the ships at the channel entrance to the atoll, transferred the patient, and thus allowed the ships to continue in convoy.

One night a hospital ship received orders to sail the next morning at dawn. Its mission made it advisable to have the greatest number of beds available. Between midnight and dawn the ambulance boat removed all patients whose condition would permit, and transferred them to other ships in the harbor.

A carrier at anchor in Leyte Gulf was hit by a plane which crashed into its flight deck. The resulting fire caused many casualties. The ambulance boat went to the scene immediately, transferred many of the patients to a nearby hospital ship, and thus made it possible for the medical staff of the carrier to treat the rest of the casualties more efficiently.

The Bureau of Medicine and Surgery considered that a continuing need existed for such a boat and recommended to the Bureau of Ships that a standard conversion plan be developed.



IMPROVED ELBOW JOINT FOR ARTIFICIAL ARMS

A PRELIMINARY REPORT

JAMES B. VAIL

Commander (MC) U. S. N. R.

While supervising the convalescence and rehabilitation of a group of amputees at the United States Naval Special Hospital, Santa Cruz, Calif., awaiting return to the United States Naval Hospital, Mare Island, Calif., for further treatment, several inadequacies in the artificial arms being supplied to patients were noticed. Among these deficiencies were: (1) Difficulty and awkwardness in flexion of the extended elbow joint; (2) the absence of a semblance of normal contour at the artificial elbow; and (3) lack of positive power in extending the artificial elbow joint. Several steps have been taken to eliminate these deficiencies and to supply more satisfactory mechanisms.

The awkwardness and difficulty in flexing the elbow of the former artificial arm was due to friction of the leather traction thong against

the prosthetic upper arm and to the fact that all power was applied as straight line pull parallel to the line of the extended joint without any provision for torque. To remedy this the leather thong was replaced with steel airplane cable housed in flexible loom and power was applied around the circumference of a $3\frac{1}{4}$ -inch wheel mounted on the elbow joint as an axis. The cable was attached to the center of the forearm rather than to the side, as had been the case previously. This new application of power resulted in such smooth, easy flexion of the elbow that the idea was developed further and a grooved wooden ball (figs. 1 and 2) and later a grooved hollow aluminum casting (figs. 3 and 4) was built into the artificial forearm. Power for flexion is applied through a cable originating on the posterior superior aspect of the shoulder harness, traveling down the posterior aspect of the arm and tunneled through the posterior and lateral part of the arm just above the elbow (figs. 1 and 3) and led to the groove in the aluminum casting. The rounded posterior surface of this wooden ball and the subsequent aluminum casting supplies a rounded contour closely simulating the extensor surface of the normal elbow and filling the gap so noticeable on the posterior surface of the older type arm.

The addition of another conduit and cable enabled the patient to extend the artificial elbow with positive power so that he no longer had to depend on gravity for this motion. This cable originates on the anterior surface of the shoulder harness, passes down the medial surface of the upper arm through a loom tunnel around the postero-medial aspect of the arm just above the elbow (figs. 3 and 4) and is led to the groove in the posterior or extensor surface of the aluminum casting. Both flexor and extensor cables are fixed to the distal part of the casting. The stabilizing effect of these two opposing cables has been so marked that two cumbersome straps in the shoulder



1. First modification in artificial arm, anterior view. Cable for flexion tunneled through to groove on circumference of wooden ball.



2. First modification in artificial arm, posterior view. Rounded contour posteriorly provided by wooden ball.

harness have been eliminated. No change has been made in the cable mechanism which operates the opening and closing of the hook.

The ease of operation of the artificial arm when these alterations have been made has been very gratifying to patient and staff alike. The patient pictured in the figures has developed a marked increase in dexterity and power with the artificial elbow joint as modified at this activity.

The ideas and principles applied in this work have been discussed with and passed on to the amputation



3. Second modification in artificial arm, anterior view. The first aluminum ball casting incorporated into the artificial forearm.



4. Second modification in artificial arm, posterior view. Cable for flexion originating posteriorly and cable for extension originating anteromedially.

section of the surgical staff at the United States Naval Hospital, Mare Island, Calif., for further development and application on a larger scale in the artificial limb shop at that activity.

CONCLUSION

Three gross inadequacies in the artificial forearm, (1) difficult flexion, (2) abnormal elbow contour, and (3) lack of positive power of extension, have been eliminated at this hospital by a change in elbow design, the incorporation of an additional cable, and the application of the torque principle. A greatly improved artificial arm has resulted.

ACKNOWLEDGMENTS.—Many of the ideas and the technical skill in designing and constructing this new elbow joint have originated and have been applied with the aid of the ingenuity and inventiveness of William L. Fitch, civilian engineer and electrician, employed by the civilian contractors operating the physical plant of this hospital.

The untiring cooperation and the constant enthusiasm of the patient shown in the figures, Pfc. John McCulley, U. S. M. C. R., contributed in no small measure to the development and the practical application of these new ideas.



SIMPLIFIED SOLID MEDIUM FOR CULTIVATION OF *BACTERIUM TULARENSIS*

Author's summary.—A simplified medium for the cultivation of *Bacterium tularensis* is described. The main factor is cystine and the basal medium an infusion of calf's liver with sodium chloride, glucose and peptone; the medium is solidified with 2.5 percent of agar.

B. tularensis grows abundantly in this medium, but for first isolation of the organism it is recommended to add from 5 to 8 percent of blood.—TOVAR, R. M.: Simplificacion del medio solido para cultivo de *bacterium tularensis*. Rev. d. Inst. salub. y enferm. trop. 6: 181-184, September 1945.

EDITORIALS

FOLIC ACID IN SPRUE

All the etiologic factors in sprue are not known, although it is generally classed now as one of the deficiency diseases. Certainly either the lack of some substance in the food or inability of the body to metabolize certain essential substances is the basis of the disease. That susceptibility to climatic conditions may be the cause of the body's inability to function properly seems likely in view of the notable effects of climatic change on the sprue case.

The characteristic features of sprue are :

1. A pultaceous, voluminous, frothy diarrhea.
2. Soreness and erosions of the tongue and mucosa.
3. An anemia resembling somewhat that of pernicious anemia except that nucleated red cells are rare. Large red cells (macrocytes) and a high color index are common.
4. Loss of weight.

Spies and his associates, Vilter, Ninnich, Koch, Lopez, Menéndez, and some others have shown that folic acid given either by mouth or parenterally produces striking clinical response in sprue and, indeed, in all types of macrocytic anemias.

In a trial with 45 cases reported in the Lancet for 16 February 1946, Spies gave 20 to 50 mg. intravenously and 20 mg. intramuscularly. By mouth the dose ranged from 10 to 400 mg. Where 20 mg. or more were given orally, one-half was given in the morning and one-half in the afternoon. Twenty mg. by mouth or parenterally was the dosage tentatively recorded to be continued for 10 days.

For oral administration they mixed 20 mg. with a few drops of water to make a smooth paste. Enough water to make 20 cc. was added, stirring constantly. The patient drank this and enough water to rinse the glass was added, which was also taken.



HOW MANY LEPERS IN THE WORLD?

The Oficina Sanitaria Panamericana published a communication in May 1940 estimating the number of lepers in the world. The number given was from 5 million to 10 million. The wide range of the estimate shows how little accurate statistical information is available. The census of lepers in Africa and Asia is so uncertain that any estimate is likely to be far from the mark. However, in South America, Europe, and North America, rather complete and careful counts of the number of lepers have been made. In Europe the number was 9,988. In North America, 9,173, and in South America, 71,300, a total of 90,361 for these three continents. Many marked changes have occurred in the distribution and incidence of leprosy. Thus in Norway, where in 1856 there were 2,850 known cases, there were only a total of 18 in 1937. In Poland, in 1938, when that country had a population estimated to be nearly 35 million, it was stated that no leprosy existed. Sweden reported 10 cases, while in Spain there were approximately 1,000 cases. The reasons for these differences are not clear and indeed the distribution of leprosy presents an interesting medical enigma. Differences in statistical methods and the reluctance of certain agencies to give information account for some of the apparent paradoxes in the statistics. There is no doubt, however, that marked changes in incidence have taken place in various countries. There is no explanation, however, for certain features of the geographic distribution of lepers or for changes in incidence in the same locality and climate. Leprosy, one of the oldest described diseases, is still a fertile field for research.



BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

CLINICAL ROENTGENOLOGY OF THE HEART, by *John B. Schwedel, M. D., Associate Attending Physician, Medical Division, Adjunct Attending Physician, Dept. of Roentgenology, Montefiore Hospital, New York; Attending Electrocardiographer and Associate Visiting Physician in Medicine, Gouverneur Hospital, New York; Lieutenant Commander (MC.) U.S.N.R.* 380 pages; 749 illustrations on 232 figures. Paul B. Hoeber, Inc., New York, N. Y., publishers, 1945. Price \$12.

The latest addition to the long series of monographs from the *Annals of Roentgenology* affords a competent review of cardiac roentgenology with emphasis on clinical correlation. It thus serves to give needed emphasis to the value of roentgenology in cardiac diseases.

In general, the plan of the book involves detailed consideration of the individual heart chambers and of the great vessels, after the introductory chapters on methods, mensuration and normal variations; then follows chapters on the lungs, pericardium, congenital heart diseases, cardiac displacement and calcifications. Illustrations and diagrams are numerous and, in the main, excellent. There are a few electrocardiographs and kymographic studies. The bibliography is most extensive. There is brief description of contrast visualization.

The chapter on mensuration has standard prediction tables for the transverse diameter and the surface area; also Kirch measurements. Discussion is somewhat limited and it is believed that more ample treatment would have been profitable here.

The chapters on the individual chambers and blood vessels are uniformly excellent and that on the lungs is especially welcome since, despite the great importance of the matter, treatment in many books

is often sketchy. This particular chapter is a most valuable and distinctive contribution.

The remaining chapters are also very good, and it is with some hesitation that one points out what appears to be a certain deficiency. From the standpoint of the roentgenologist, and particularly in relation to teaching, this reviewer believes that the value of the book would have been enhanced by a chapter on analytical approach to diagnosis, i. e., what one may or may not deduce from abnormalities as they present in roentgenological studies. That is perhaps too elementary to expect in a book organized along different lines but one would like to see it nonetheless. It would help to bring the whole matter into focus along work-a-day lines.

In summing up, one can say that the book is a valuable addition to cardiac literature and that cardiologists, roentgenologists, and internists will find it a very useful reference.

HACKH'S CHEMICAL DICTIONARY, completely revised and edited by *Julius Grant, M. Sc., Ph. D., F. R. I. C.* 3d edition. 925 pages; illustrated. The Blakiston Co., Philadelphia-Toronto, reprinted in 1946 with changes and additions. Price \$8.50.

This celebrated dictionary was first published in 1929. In 1937 it was reprinted and revised. The author at that time in his preface quoted the words of Berzelius that "the devil should write books on chemistry, for every few years the science changes." The third edition was in 1944 but by 1946, the date of this printing, many changes and additions were made to bring the book strictly up to date. It is not too much to say that this is the best chemical dictionary in the English language, at once practical and authentic. Included in this edition are many new features. Of great interest is a table showing radio active disintegration and the rare earth metals. There are tables of natural resins and balsams. As an example of the practical character of this dictionary, there is listed under the title "Bark" the official barks of the United States Pharmacopeia; under the definition "Barrel" the official quantities of various substances are given for this measure. Pictures and brief biographies of famous chemists are included and the whole book is illustrated by a number of good line cuts. For both the chemist and the undergraduate in chemistry, this book is a necessity.

DISEASES OF THE NOSE, THROAT, AND EAR Including Bronchoscopy and Esophagoscopy, edited by *Chevalier Jackson, M. D., Sc. D., LL. D., F. A. C. S., Honorary Professor of Broncho-Esophagology, Temple University, Philadelphia; and Chevalier L. Jackson, M. D., M. Sc., F. A. C. S., Professor of Broncho-Esophagology, Temple University, Philadelphia; with the collaboration of 64 outstanding authorities.* 934 illustrations on 581 figures including 18 plates in color. W. B. Saunders Co., Philadelphia, Pa., publishers, 1945. Price \$10.

This most recent and welcome addition to the libraries of otolaryngologists states in the preface that it is a textbook whose purpose is "to present the various phases of modern otorhinolaryngology and broncho-esophagology in a form most practical for those interested in these specialties, be they students, teachers, specialists, or general practitioners." Thus the work is another attempt to present a great mass of technical and highly specialized information within the covers of one not too large volume which will fill the needs of all the classes of those using the information in their daily work. The inherent difficulties of this task are soon apparent when one considers the needs of each class.

The undergraduate student, burdened with the enormous amount of information he must digest in his studies, needs a book that considers the basic facts of common diseases of the field briefly and simply; the general practitioner, too, needs information quickly and in simple form for his immediate needs in actual diagnosis and treatment. The teacher of otolaryngology and the fully qualified specialist have gone far beyond this stage, and require full considerations of rare diseases as well as the common, and all the wealth of small detail concerning manipulative and surgical procedures which properly fall within the scope of their activities. Hence a textbook which would satisfy all the demands upon it would have to be at once brief and yet comprehensive, giving proper attention to both rare and common conditions, outlining simply the accepted methods of ordinary diagnosis and treatment, and yet describing in full highly technical operations.

The present book is a very thoughtful and skillful attempt to fulfill all of these needs at once, but it must be stated in all fairness that the attempt has not been completely successful. The inherent difficulties as sketched above make it certain that still other attempts to write the ultimate textbook will be made in the future.

The book consists of 415 large pages containing information on the diseases of the nose and accessory nasal sinuses, the mouth, fauces and pharynx, and the ear. These have been written by some 51 authors whose names encompass the leading authorities in American otolaryngology today. The last 380 pages are given over to discussions of the diseases of the larynx and hypopharynx, the trachea and bronchi, and the esophagus, with a study of foreign bodies in the air and food passages, and some general considerations, written almost entirely by the senior author-editor of the work, who is surely the leading authority on these subjects in the world, by universal acclaim. He is aided by sections from the pens of junior author-editor and 11 other recognized authorities in the fields on which they write.

The inclusion of sections on traumatic maxillary surgery, and the reconstructive surgery of the nose and ear occupy considerable space,

and can only serve to illustrate by a few selected cases what can be done in these very special fields, and not how it can be accomplished, except in a few details. The sections on the diseases of the mouth, tongue and salivary glands cover conditions often seen by the otolaryngologist, though perhaps belonging in the field of the general medical man or oral surgeon. The section on the irradiation treatment of hyperplastic lymphoid tissue in the nasopharynx is a welcome review of this new and promising work. The summary of the pharyngeal phases of blood dyscrasias is very useful.

The sections describing the technic of lateral transthyroid pharyngotomy for malignant disease, and of cancer of the nasopharynx by radiation are short masterpieces. The sections dealing with the examination of the ear, of the function of hearing, and of the functional examination of the labyrinth serve as excellent introductions into the newly renaissance subjects of deafness and neuro-otology. Emphasis on new and vitally important work is further given in the section on Meniere's syndrome, and on the pathology and surgical treatment of otosclerosis, in which great advances have recently been made.

The many sections written by Chevalier Jackson and his co-authors in the latter half of the book, are easily the stronger part of the text, and constitute a fresh statement of many facets of the highly technical and important subject in language that is clear, concise, and authoritative indeed.

The final sections on general considerations comprise in part an interesting consideration of endoscopic photography, of modern chemotherapy in otolaryngology, and of anesthesia that are well worth study, and finally an essay by Chevalier Jackson on the general phases of the examination and treatment, what may be called the "philosophy" of the practice of otolaryngology that is eminently "Jacksonian" and most interesting.

The book is a large one, meant for reading on the desk or study table, well bound and printed in two columns on the page on coated paper in large and easy-to-read type. It should be in the library of every otolaryngologist and endoscopist as a very worthy addition, containing a great fund of worth-while and up-to-the-minute information.

PRESCRIBING OCCUPATIONAL THERAPY by *William Rush Dunton, Jr., M. D.*
2nd edition. 144 pages. Charles C Thomas, Springfield, Ill., publishers, 1945.
Price \$2.50.

The purpose of the author of this book was to present the subject briefly so "that it might be quickly apprehended by the busy physician or medical student" or perhaps as a manual. However, the textual contents lack substance and one is left with a feeling of vagueness after reading them.

This book endeavors to advance the cause of the so-called occupational therapy, a misnomer, and tries to combine the occupational with psychic influences which are better left to another field. It also endeavors to justify the occupational therapist or, more properly, technician who is given to conducting various forms of diversional procedures as well as exercises to be carried out by the patient rather than applied by the technician.

The word "occupation" is used instead of "diversion," "entertainment," or similar designation of physical means to the end sought, and such expressions as psychotherapy, music therapy, or other prefixes to the word therapy cover a multitude of approaches to various problems.

The presentation of the subject is quite superficial and unstimulating and interest flags, yet the book is intended to arouse interest in the field and to serve as a guide, although the author admits "brevity has been purposely sought." Much of the text is a presentation of axiomatic statements rather than direct instructions or outline of methods.

The author would do better by swinging to the more universal title of Physical Medicine to cover the physical and mechanical measures for one part of the book and to a second part which would include the psychology and emotional analysis as an approach to the application of treatment which governs this phase of the patient's condition.

The book is not recommended for more than an introduction for technicians.

MANUAL OF DIAGNOSIS AND MANAGEMENT OF PERIPHERAL NERVE INJURIES by *Robert A. Groff, M. D., Lieutenant Colonel, M. C., A. U. S.; formerly Assistant Professor of Surgery, Jefferson Medical College, and Assistant Professor of Neurosurgery, Graduate School of Medicine, University of Pennsylvania and Sara Jane Houtz, B. S., First Lieutenant (P. T.) A. U. S.; with an introduction by I. S. Ravdin, M. D., Brigadier General, M. C., A. U. S.; John Rhea Barton Professor of Surgery, University of Pennsylvania.* 188 pages; 111 original illustrations. J. B. Lippincott Company, Philadelphia, Pa., publishers, 1945. Price \$8.

This is an excellent manual written for the purpose of providing physicians and physical therapists with a concise text containing the essential facts for the understanding and management of injuries to the peripheral nerves. It is regretted that this valuable book did not appear two or three years earlier. It would have helped many inexperienced young medical officers out of some of their difficulties. The author is a neurosurgeon and his collaborator is a physical therapist; an excellent combination. There is a foreword by Gen. I. S. Ravdin, who, among other things, describes the difficult conditions under which the book was written on the Assam-Burma border.

The book is wisely conceived, simply written, and beautifully illustrated. It contains over 100 fine original illustrations. The first part of the volume is concerned with a general consideration of nerve

lesions. The physical treatment is discussed in detail, and postoperative care of the patient is considered from the standpoint of both the surgeon and physical therapist.

Part II discusses peripheral and cranial nerve function, and is profusely illustrated with action diagrams. The authors intend these diagrams to serve two purposes; first, the visualization of the action of particular muscles, and secondly, to serve as a guide for the physiotherapist in administering specific muscle exercises.

This book will be extremely valuable for students, physiotherapists, and for surgeons. It is the type of volume which should be in ships' medical libraries and in the library in any locale in which individual medical officers might require an easily understandable manual of nerve lesions. It will be a welcome adjunct to hospital libraries. One might hope that some way will be found to make succeeding editions a little less expensive, and more within the reach of inquiring but often impecunious students.

SURGICAL TREATMENT OF THE MOTOR-SKELETAL SYSTEM. *Supervising Editor, Frederick W. Bancroft, A. B., M. D., F. A. C. S., Associate Clinical Professor of Surgery, Columbia University; Attending Surgeon, New York City and Beth David Hospitals; and Associate Editor, Clay Ray Murray, M. D., F. A. C. S., Professor of Orthopedic Surgery, College of Physicians and Surgeons, Columbia University; Attending Surgeon and Chief of the Fracture Service, Presbyterian Hospital and Vanderbilt Clinic, New York City.* PART ONE: Deformities, Paralytic Disorders, Muscles, Tendons, Bursae, New Growths, Bones, Joints, Amputations. 612 pages; with 520 illustrations and a color plate. PART TWO: Fractures, Dislocations, Sprains, Muscle and Tendon Injuries, Birth Injuries, Military Surgery. 1254 pages; with 543 illustrations. J. B. Lippincott Company, Philadelphia, Pa., publishers, 1945. Price, set, \$20.

This work is divided into two parts and bound in two volumes, one part to each. The first part has 520 illustrations and 1 color plate and the second part 543 illustrations, a total of 1,064. There is an unusual profusion of pictures, mostly photographs which fully enhance the text. These are beautiful books, well bound and especially well printed in a clear, easily visualized type, on high gloss paper and easy to hold, each containing about 600 pages plus 29 of index.

It is a pleasure to read these books. The text is complete, clearly phrased with full authoritative statements and directions and most satisfyingly instructive. The text goes along with the illustrations so that one can glance at the picture as he follows the description of the condition or procedure.

Considerable detail is used in describing the conditions, structures, defects, etc., and the treatment is meticulously stated, greatest care being taken to make all things clear. The style is the same throughout although one author follows another. The narrative is such that it inspires confidence and leaves one with the sense and feeling of

sureness and certainly that the procedure or treatment is the best and the one with the greatest hope for success.

Part I covers deformities, paralytic disorders, muscles, tendons, bursae new growths, bones, joints, and amputations, each section being complete in itself.

Part II covers fractures, dislocations, strains, muscle and tendon injuries, birth injuries, and war surgery, this being a thesis by the Surgeon General of the Army fully describing medical service units organization and scope of activities.

The foregoing arrangement of the subjects is a most happy one as related conditions or situations join in contiguous sequences. The contents are divided into sections and these into chapters, and for the most part each chapter is the work of a separate author and a monograph on his subject. The authors are most outstanding specialists in their field. The editor has done well in his compilation and arrangement and editorial management of the matter so that the text flows like a continuous story rather than broken context as is often the case in joint publications of monographs.

This book should have unqualified recommendation for the use of specialists, practitioners, students, and should be in the hands of all medical officers of the military services.

HYPNOANALYSIS by *Lewis R. Wolberg, M. D., Lecturer in Psychiatry, New York Medical College.* Foreword by *A. Kardiner, M. D., Assistant Clinical Professor of Psychiatry, Columbia University.* 342 pages. Grune & Stratton, New York, N. Y., publishers, 1945. Price \$4.

There has been a recent tendency in psychiatric treatment toward the development of brief methods of psychotherapy. Particularly has the war made acute the need for incisive methods with which the psychotherapist can come to grips with those of his patient's problems which are either wholly or partly inaccessible by the more usual and ordinary methods. Narcosynthesis and narcoanalysis, hypnosis and hypnoanalysis are somewhat related technics of the newer approach, which have attracted considerable attention. They differ only in that the former two employ the use of barbiturates to moderate the patient's psychological inhibitions.

The practitioners of psychoanalytic psychiatry have written most in this field. Based on the Freudian philosophy that earlier repressed, unconscious psychic traumata are the anachronistic causes for current psychological symptoms, analysts have exploited these more rapid methods to afford them access to these data. On addition to their purely exploratory values, these instruments of "depth psychology" have been used to help the patient consciously free himself from the yoke of his symptoms.

This book is among the first of a rather small series of full reports on this aspect of psychotherapy. It differs from many other psychiatric treatment texts in that it attempts to specify by case illustration the flexibility and usefulness of hypnosis. While the author is enthusiastic, he is moderate in his claims. The first part of the book, fully half of its total pages, is devoted to a detailed hypnoanalytic presentation of one psychotic patient.

Making allowance for the fact that the author assumes that the reader is familiar with psychoanalytic language, procedure and dynamics, he does a very creditable job of demonstrating and explaining his use of the whole gamut of hypnotic procedures, automatic writing, crystal gazing, posthypnotic suggestion, hypnotic drawing, hypnotic free association and dream induction.

As psychoanalytic writing goes, this is an example of a reasonably clear and logical exposition. The nonanalytic psychiatrist can find much to argue with in this book; however, it is to the author's credit that such demurrers are contra the Freudian credo and not the author's pronouncement of it.

PSYCHOLOGY FOR NURSES, Designed and Written for Student Nurses, by *Bess V. Cunningham, Ph. D., Professor of Education, University of Toledo, Toledo, Ohio.* 336 pages; illustrated. D. Appleton-Century Company, Inc., New York, N. Y., publishers, 1945. Price \$3.

The book *Psychology for Nurses* would be a useful addition to any library for nurses. Students should find it particularly interesting since it is written for and about nurses.

The division of the chapters into subjects is helpful to students. Instructors gain helpful teaching suggestions by the "Suggested Activities" at the end of each chapter.

The illustrations are very graphic and tend to enhance the subject material. They are simple but clear, lending interest to the reader.

The correlation of child psychology and physiology with the fundamental principles of psychology is most beneficial for nurses.

I have found the book to be well written and very interesting. An instructor in a school of nursing should find it most adaptable as a nursing text.

PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge

MALARIA AT A CARIBBEAN BASE

PATRICK J. FITZGERALD

Lieutenant (MC) U. S. N. R.

The Caribbean area is a well known endemic focus of many tropical diseases of which malaria is one of the most prominent. In this area the United States has maintained a permanent naval station at Guantanamo Bay, Cuba, since 1903. For many years the station was small and the personnel few, but in the latter part of 1940 a huge construction and training program began that was to increase the base and personnel at least tenfold. Malaria, which had not been regarded previously as a serious problem, began to increase in 1940 and in 1941 had become a problem of major concern.

It is the purpose of this report to summarize, from the years 1930 to November 1945, the available data on malaria at this permanent base.

LOCALE

The base is located in Oriente Province at the eastern tip of Cuba on the southern shore of the island fronting on the Caribbean Sea. Carr et al. (1) have given an extensive description of this Cuban province in their malaria survey of the region. Base topography and local conditions have been well described by Brown and Ware (2) who point out that it is essentially a low-lying, flat, swampy area along the coastline partially encircled by a rim of small mountains. Over an 8-year period the average monthly maximal temperature has not risen above 92.4° F., nor has the average monthly minimal temperature during that time dropped lower than 61.4°. Rainfall, to be described more in detail later, is light except for a few months of the year. Natural watersheds drain off to the ocean some of the residual rainfall and the porous soil favors a quick run-off of the remainder.

INCIDENCE

From 1930, the date of the earliest available records, to 1940 there were only 63 cases of malaria diagnosed in naval personnel and 40 in

civilians. (See table 1.) The station was small, there were few recreational facilities available for ship's personnel liberty, native employees were few, and little excavation or building was done. In 1930, 1931, 1932, and 1938 there were no cases of malaria diagnosed in servicemen and only two in native employees. Up to 1940 the maximum number of cases in naval personnel during a year (1936) was 17.

TABLE 1

Year	Malarial cases			Yearly total admissions	Percentage malaria admissions (service) to total admissions
	Service	Civilian	Total		
1930	0	0	0	573	0
1931	0	1	1	601	0
1932	0	0	0	441	0
1933	6	7	13	314	1.9
1934	15	8	23	527	2.8
1935	10	8	18	319	3.1
1936	17	6	23	229	7.4
1937	14	9	23	240	5.8
1938	0	1	1	382	0
1939	1	0	1	572	.2
1940	12	3	15	1,313	.9
1941	56	57	113	1,920	2.9
1942	51	25	76	4,367	1.2
1943	65	22	87	3,232	2.0
1944	19	3	22	2,243	.8
1945 ¹	141	52	193	2,161	6.5

¹ To 1 Nov. 1945.

With the great construction program of 1940-41 there were created, as is usual in the history of malaria, many man-made obstructions to proper drainage, some more extensive than the natural ones, with the same inevitable results of increased mosquito breeding. Added to this factor was the importation of thousands of Cuban laborers who served as a reservoir of infection. Thus in 1940 there were 12 cases in naval personnel and 3 in natives employed on the base. In 1941 the number of cases increased to 56 servicemen and 57 civilians, and the rate per thousand service personnel per month went as high as 14.73 (fig. 1). Subsequent to a heavy rainfall in October 1942 there again appeared an increase in the malaria incidence, though considerably less than the previous rise.

Early in 1943 there were inaugurated two excellent programs—one, an engineering project which has remedied most of the man-made ills; the other, a mosquito control regime that has been followed by a reduction in anopheline mosquitoes (fig. 1). As a result of measures instituted in that year the prevention of base-acquired malaria has been essentially a matter of close supervision of personnel and intelligent utilization of existing facilities. Although the yearly number of cases remained elevated there was a drop in rate in 1943 and 1944

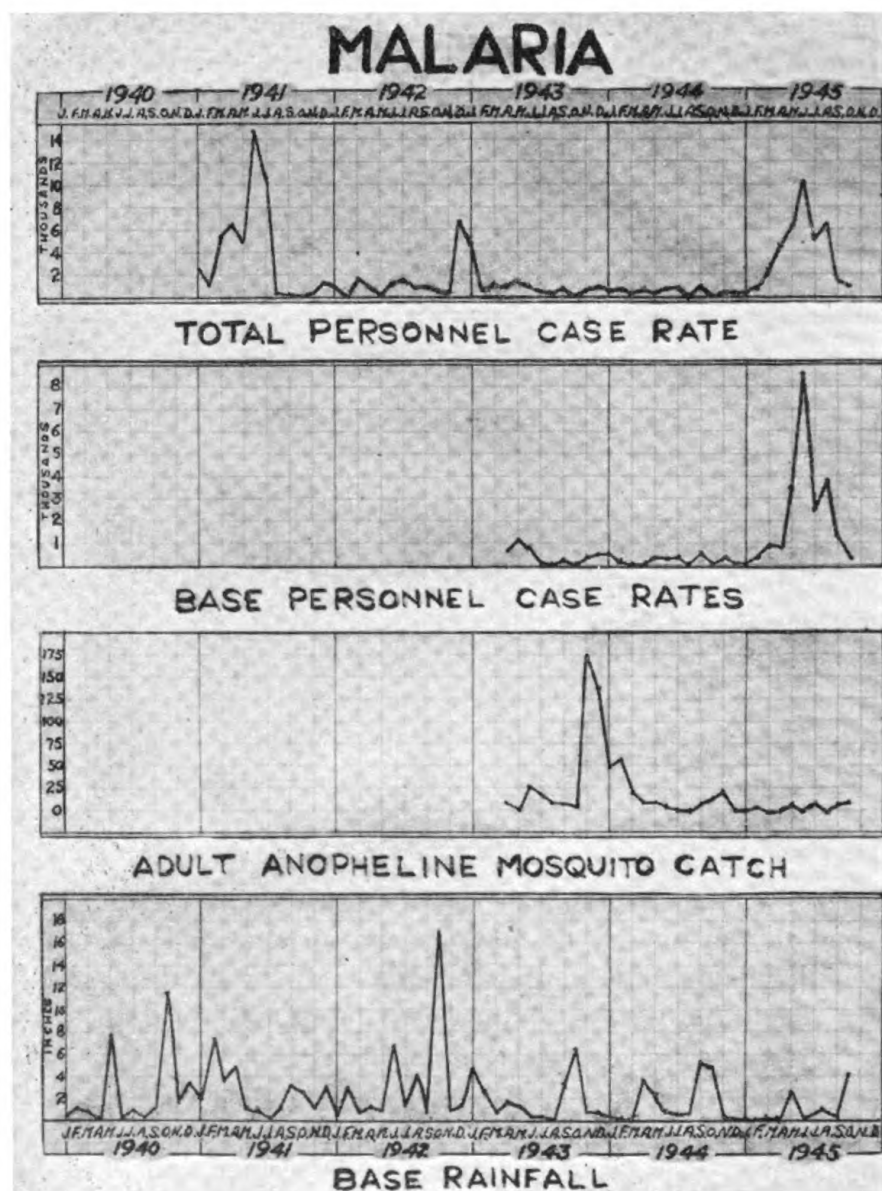


FIGURE 1.

with the increase of personnel on the base. In 1945 another increase in incidence occurred and in the first 10 months of this year there were 141 cases in service personnel with a corresponding increase in civilian cases to 52. This occurred even though rainfall was light and very few anopheline mosquitoes were present on the base or out-post areas (fig. 1). However, most of the patients had visited the nearby cities of Guantanamo and Santiago de Cuba from 2 to 4 weeks prior to the onset of symptoms and it is believed that infection was acquired in these highly infected areas (2).

It is of interest that in the years 1934 to 1937 when malaria was not considered a serious problem, the ratio of malaria admissions to total admissions of service personnel was sometimes higher than in the forties (except for 1945) when total cases were greater (table 1). Also significant, it is believed, is the generally parallel trend of total civilian and total service cases.

TYPES

There is a surprising predominance of infection with *P. falciparum* at Guantanamo Bay (table 2). In this series of 381 cases, 169 (44.4 percent) were diagnosed as such while *P. vivax* infections were present in only 14.4 percent. Infections with *P. falciparum* are generally second in incidence throughout the world to *P. vivax* although regions exist where the former is more common. In the Pacific area Simpson et al. (4) found that 37.6 percent of their 1,184 cases showed *P. vivax* while 28.3 percent were caused by *P. falciparum*. Throughout Cuba infections are about equally divided between these two (3) except for Oriente Province. In this region 139 smears were taken (1) and *P. falciparum* was identified in 77 (55.4 percent). *Plasmodium vivax* was present in 60 (43.2 percent).

TABLE 2.—Analysis of 381 cases *

Type	Number	Percentage	Primary	Recurrent
<i>P. falciparum</i>	169	44.4	154	15
<i>P. vivax</i>	55	14.4	44	11
<i>P. malariae</i>	16	4.2	4	12
Mixed (<i>P. falciparum</i> and <i>P. vivax</i>).....	1	.3	7	?
Undetermined.....	86	22.5	75	11
Clinical diagnosis.....	54	14.2	24	30
Total.....	381	100.0	301	79

*There were 26 cases of malaria with insufficient records. These are not included in the above analysis.

The diagnosis of *P. falciparum* was not easy for in only three service cases were the specific gametocytes of this type seen. In the remainder the usual findings on a thin film were a few normal-sized erythrocytes showing two or more small trophozoites, frequently of the marginal forms, per cell. The presence of schizonts, gametocytes other than the easily recognized ones of *P. falciparum*, Schüffner's granules, *P. malariae* pigment or band forms, or large parasitized erythrocytes meant that a diagnosis of *P. falciparum* was in error. In addition, it was required that at least one repeated smear, at a different time interval in relation to a paroxysm, show similar findings before the diagnosis was substantiated, for it has been stated that *P. vivax* infections may show multiple parasites in red cells (5). As a result of these requirements many cases with positive smears were unclassified as to species though it was felt that they were probably *P. falciparum*.

Plasmodium malariae was diagnosed in 16 cases, 2 of these by the author. Four may have been acquired in the Caribbean area. Only two *P. malariae* infections were found in Cuba by Carr and Hill (3) and both were from Oriente province. One case of mixed infection, *P. falciparum* and *P. vivax*, was seen.

Type unspecified diagnoses comprised 22.5 percent of the total cases. Parasitemia was light in most of the patients and frequently only a few trophozoites would be seen in a thick film and only a rare one in a thin film. Occasionally three to five negative smears were taken before a positive one could be found. Similar difficulty in determining species has occurred in the Pacific area and type unspecified diagnoses have been as high as 33.6 percent (4). Diagnosis by clinical signs and symptoms without a positive blood smear confirmation occurred in 14.2 percent of cases. The majority of these had a previous infection and most showed the classical features of the disease.

Thick and thin films stained with Giemsa or Wright stains were generally used prior to 1945. In that year the Field rapid technique for staining thick films was introduced and found highly satisfactory and time saving. Wright or Giemsa stains were then used on thin films for species identification in these patients showing a positive thick film.

CLINICAL CONSIDERATIONS

Diagnosis.—In 316 cases proven by positive smear, the diagnoses were made or suggested upon admission in 219 (69.3) percent. Many of these patients had a suggestive history of chill, fever, and sweating, showed hyperpyrexia, and usually had been exposed to mosquitoes in known malarial regions about 2 weeks prior to entrance. However, in these cases the severity of symptoms described in textbooks was infrequently seen and our patients were only mildly incapacitated as a rule. Frequently, malaise, a slight chill followed by feverishness, and dull headache were the only symptoms. The temperature upon admission usually ranged from 99° to 102° and very often was only 100° F. or lower.

Respiratory and gastro-intestinal symptoms were very common in our malaria patients and caused considerable trouble in diagnosis. In the 97 cases of malaria that the diagnosis was not made upon admission, 17 were admitted with the noncommittal, "Medical Observation." Of the remaining 80 cases, 57 were admitted with systemic and respiratory complaints that caused them to be labeled catarrhal fever, acute. Applebaum and Shrager (6) found that 3.7 percent of the 2,237 young, white, military personnel with malaria had an associated pneumonitis. Eleven patients were admitted with

gastro-intestinal complaints and the majority of these were diagnosed gastro-enteritis, acute. The involvement of the intestinal tract in malaria has been pointed out by many (7 to 10), and Hughes and Bomford (11) stated that gastro-intestinal complaints were predominant in about 10 percent of their 816 *P. falciparum* cases in British troops in West Africa.

The difficulty in differentiating the pulmonary and gastro-intestinal symptoms associated with malaria from a primary, nonmalarial pulmonary or gastro-intestinal disease is illustrated by the opposite mistake-cases diagnosed as malaria upon admission in which the diagnosis could not be established by repeated smears nor clinical course. There were 88 such cases that the ward officer changed the admission diagnosis to that of another disease. Although some of these may have been cases of malaria, all had repeated negative blood smears and none had any clinical findings sufficient for the diagnosis of malaria. Forty-six of these cases were discharged with a respiratory disease diagnosis, usually catarrhal fever, acute. Seventeen were discharged with a gastro-intestinal disease diagnosis, most frequently gastro-enteritis, acute. Of the remaining 25 cases the list of discharge diagnoses was a long and varied one including such unrelated diagnoses as: Poisoning, therapeutic (Mapharsen), heat exhaustion, infectious hepatitis, anxiety neurosis, otitis media, and no disease.

A complicating factor in diagnoses may have been an incidental parasitemia in patients with a primary gastro-intestinal or respiratory disease. Also possible was the activation of a latent malaria by such infections. However, the frequent quick response to atabrine treatment, and the marked drop in catarrhal fever, acute, diagnoses and a corresponding increase in malaria diagnoses when routine malaria smears were taken on all dispensary and out-patient cases are of note. Also significant was the occasional patient who was found to be chronically ill, showed malarial parasitemia, and gave a history of one or two previous admissions either for respiratory, or for gastro-intestinal disorders. These few patients did well and were asymptomatic after antimalarial treatment.

Complications.—In this series of cases there were two deaths. One was that of a chief boatswain's mate who was admitted to the dispensary in 1940 from a ship. He died in coma. It cannot be ascertained where he was exposed to malaria. The other was that of a marine sentry who was detailed in 1942 to duty at a base outpost area known to be heavily infective. He died of blackwater fever. Two cases showed the cerebral form of malaria infection and both recovered. A case of transverse myelitis associated with malarial parasites in the blood did not respond to antimalarial treatment. One case of periph-

eral neuritis and parasitemia did recover on similar therapy. Two cases showed parasitemia and icterus with hepatomegaly. In all the above cases *P. falciparum* was identified. Two cases of psychogenic malaria were seen. These men insisted that they were suffering recurrent attacks of malaria although clinical findings and blood smears were negative. Merrill has described similar cases (12).

The recurrence rate could not be determined accurately because of the frequent change of personnel. The number of admissions that were recurrences or reinfections is given for each species in table 2. In a group of 20 pharmacist's mates, admitted to the dispensary for malaria and observed from 6 to 18 months, 9 had recurrences. Fifteen of the twenty cases, and seven of the nine who had recurrences showed *P. falciparum* in blood smears. The others were not typed.

Of interest, in view of the relative mildness of most of our cases, is the report (2) of an experimental mobile hospital that accompanied a Marine force quartered on the outskirts of the base in 1940 and 1941. This unit admitted 16 cases of *P. falciparum* malaria and 2 of these died. The discrepancy between the severity of these cases and ours is believed to be explained by the heavy, frequent inoculations of parasites that probably occurred in outlying camp sites or adjacent islands used for training. It is such severe and often fatal infections that have led to the term, malignant tertian. It is thought, however, that under unique circumstances where exposure is light or infrequent, as at this station in recent years when anopheline mosquitoes were uncommon and a fortnightly evening or two in a native community was the usual wartime exposure, the infection is much milder and often atypical in manifestations. It is believed that the latter aspects of the disease should be emphasized as well as the more dramatic cerebral and blackwater forms. Birk (13) as a result of his experiences with *P. falciparum* in British troops, has placed great emphasis upon the mild forms and states that in the chronic, afebrile type there may occur such varied manifestations as headache, backache, weight loss, diarrhea, cardiac irregularities, joint pains, and eczematoid conditions.

Treatment.—Because of the changes in medical officers and advances in therapy throughout the years there have been many plans of treatment used, ranging from the older treatment of quinine alone, to the quinine-atabrine-plasmochin, and quinine-atabrine combinations, and finally, to the use of atabrine alone. Under the atabrine-quinine-plasmochin regime the patient with *P. falciparum* infection was usually discharged on the twentieth to twenty-fifth day of his hospital stay. Later, with a combination of atabrine and quinine

the period of hospitalization was shortened to 14 to 18 days. Most recently, the intensive treatment with atabrine has shortened the stay even more. Whether this is because of greater drug efficiency, or because of varying ideas on treatment by different medical officers, cannot be answered. The records do show that the patient became afebrile in a shorter period of time after treatment with atabrine than under the other forms of treatment. Unfortunately, it is impossible to check most patients for recurrences so this complication cannot be evaluated. In a group of 15 pharmacist's mates whose *P. falciparum* infections were treated with atabrine, 4 of 7 recurrent cases required a total of 8 extra courses of either atabrine or quinine before blood smears were consistently negative. The impression was gained that the mild, atypical form of malaria is not as easily eradicated by a week's treatment with atabrine as some authors state. Simpson *et al.* showed from their experience in the Pacific that 20 percent of *P. falciparum* cases had recurrence or reinfection, and that 45.8 percent of the cases refractory to treatment were caused by this species.

MALARIA CONTROL

The malaria control unit consisted of a malaria control officer, a chief pharmacist's mate, field inspectors, and oilers. The chief and inspectors covered designated areas daily searching for breeding places, dipping for larvae, and directing the oilers. The latter had a set schedule and covered the entire base on foot every 5 to 7 days. Diesel oil, No. 2, was used satisfactorily as a larvicide and was carried in knapsack sprayers by the oilers. A light truck carried drums of oil from which the knapsacks were refilled. Additional oilers were sent out into the field following heavy rains. With the availability of DDT this was used effectively as a larvicide in a 5-percent solution of Diesel oil. Once a week five fixed horse-baited traps (14) (15) were set at key points on the base. The chief pharmacist's mate and a field inspector collected the mosquitoes from the traps and from stations on out-post areas. They were identified by the malaria control officer. No significant change was made in the method or routine of collecting mosquitoes and the figures presented (fig. 1) represent the total base catch. A portable light trap (16) was used but only a rare anopheline mosquito was caught in it. A mobile horse-baited trap, mounted in a four-wheeled carriage so that it could be drawn by a tractor or truck, was found to be quite helpful and very often would be the means of proving the presence of anopheline in a suspected area. Records were kept of the number and types of mosquitoes caught in each trap, inches of monthly rainfall, and an individual report was made on each malaria case. The patient was questioned by a member of the malaria

control unit regarding places of exposure, previous history of malaria, and other pertinent data. Since April 1943, monthly total cases have been further subdivided to show the number of cases in base personnel and transients (fig. 1). Drainage of breeding areas and other necessary engineering projects were accomplished through the Public Works Department. Lectures were given to newly arrived personnel stressing the high infectivity of nearby communities, and instructions were given on the use of repellents, bed netting, and DDT. Pamphlets on malaria were distributed. No suppressive therapy was used.

RAINFALL¹

Over a 13-year period (1932-44) the average total rainfall has been 29.5 inches per year but great variations occur (fig. 2). In 1938 only 13.29 inches of rainfall was recorded, yet, in 1933 a total of 55.06 inches occurred. Intermittent heavy rains up to 20 inches per month may be followed by months with only a trace. October has shown the highest average rainfall (9.03 inches) over a period of 13 years. June is next with 3.79 inches average. No correlation between rainfall in total inches per year and yearly total cases could be demonstrated (fig. 2). No significant relationship could be shown between the average or total cases per month and the average rainfall per month over a 10-year period. Carr and Hill (3) from their studies of Cuban epidemics could not show any relation between mean annual rainfall, or monthly rainfall, and the occurrence of epidemics. However, when the monthly rainfall is compared with the corrected case rate per 1,000 men per month on the base, the peaks of high malaria incidence of 1941 and 1942-43 follow periods of heavy rainfall (fig. 1). Yet, the very high peak of 1945 is accompanied by a low rainfall. Since only a rare anopheline mosquito was found on the base during that period, it is believed that this is further evidence that most of these latter cases were acquired off the base in nearby communities. The rainfall figures were thereby of some aid in interpreting malaria peaks and also as forecasts of potential mosquito breeding.

MOSQUITOES

The important vector of malaria at the base, as throughout Cuba, is the *Anopheles albimanus*. Also found on the base in entomological surveys were *Anopheles grabhamii*, *A. vestitipennis*, and *A. crucians*. All of these have been identified by Carr and Hill in Cuba (3). *A. albimanus* is a brackish water breeder with a preference for sunlight. Of interest has been the finding of an occasional *A. albimanus* breeding

¹The author is indebted to the Aerology Division, U. S. Naval Air Station, Naval Operating Base, Guantanamo Bay, Cuba, for the figures on rainfall.

in crab holes in swamps near the sea. This was previously noted by Brown and Ware (2). Investigation showed that land crabs had excavated to fresh water from underlying springs and that larvae and adult mosquitoes were breeding in these pools. It was believed that a few cases were caused by those mosquitoes which were found between a laundry where carriers were discovered and a barracks where base-acquired, primary cases appeared.

— MALARIA —

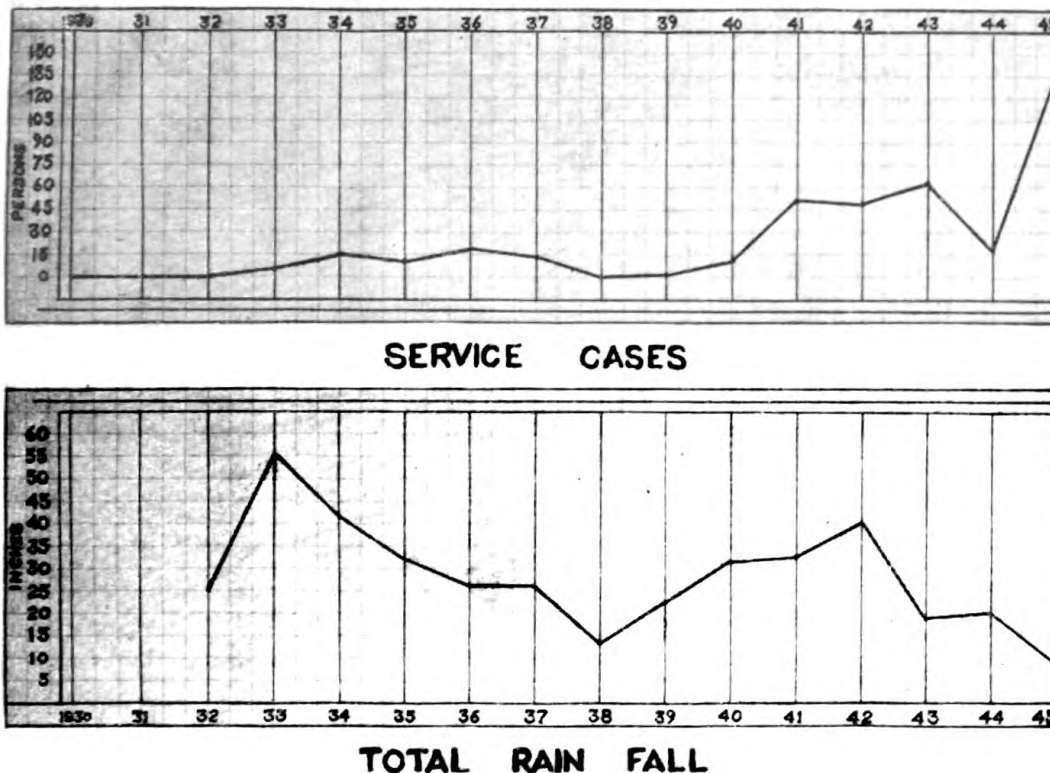


FIGURE 2.

Beginning in 1943, as part of a malaria control program, horse-baited traps were set weekly and outposts visited at the same time and specimens caught. In the 2 years that this system has been operating there has been no significant correlation between the monthly malaria rate (cases per thousand personnel per month) and the total monthly anopheline catch (fig. 1), the total mosquito catch, nor the percentage of anopheline of culicine mosquitoes. The highest catch occurred during a period (November 1943) of low malaria incidence. During the height of malarial infection in 1945 no anophelines were found on the base or outpost areas, yet similar routine had at various times found 20 to 50 or even higher. However, it is believed that such

lack of correlation was further evidence that the 1945 increase represents cases acquired off the base and emphasizes that the mosquito, like rainfall, is only one link in the chain of infection. The mosquito catch was of considerable help in focusing attention early on breeding areas and as an indicator of the presence of anophelines.

CARRIERS

Native.—Oriente Province has been shown to be an endemic focus of malaria, has been noted for its frequent epidemics (1), and records over half the malaria deaths in Cuba although it contains only a quarter of the population (3). A survey of 1,851 Cuban laborers from Oriente who were working on the base in 1940 showed an incidence of positive smears of 2.5 percent. It was estimated that more than 10 percent of the inhabitants of Guantanamo and more than 5 percent of Santiago de Cuba were carriers at this time (2).

In 1942, 103 laborers on the base and natives living nearby were examined and 35 percent showed positive blood smears (17). The author personally found that 12.5 percent of 526 natives living on the base in 1945 had malaria parasites in peripheral blood smears. Only one thick film smear was taken from each person so that the incidence of carriers can be presumed to be higher. All of these carriers were asymptomatic and at work. The importance of these natives as potential sources of malaria is obvious.

Naval personnel.—At a small outlying naval activity (A. A. T. C.) where anopheline mosquitoes were present the appearance of a few cases of malaria prompted a thick film survey of the group. Of 121 ship's company, 11 (9.1 percent) were found to be carriers. All had visited adjacent communities or had been in the Caribbean for some months. All were asymptomatic and at work.

Pharmacist's mates who went to nearby cities on duty at least once every 2 weeks showed a high incidence of malaria during the increase of the disease in 1945. Out of 85 members of the staff, 20 were found to have positive smears and were admitted to the dispensary. Ten of these were relatively asymptomatic and the other 10 had mild symptoms. Barber (18) states from experience in a tropical area that 9 to 10 percent of 224 men of a naval command showed parasites when single blood smears were taken even though all were asymptomatic and at work.

The problem of naval, as well as native carriers, is thereby a matter of considerable concern and a routine malaria smear upon the admission of service or native personnel to a dispensary or hospital in regions known to be endemic foci of malaria is obligatory. The malaria smear is certainly of far more use to proper diagnosis in the tropics than the leukocytic or erythrocytic counts.

COMMENT

In reviewing the history of malaria at this base it seems likely that the peak of malaria incidence in 1941 (fig. 1) was caused by a combination of the influx of native carriers, the heavy rains of the year, the construction program giving rise to the breeding areas for the mosquitoes, and the arrival at the station of personnel from nontropical areas. The high peak of 1942-43 followed one of the heaviest rainfalls recorded on the base. Shortly thereafter malaria control was instituted and malaria was not much of a problem until 1945. At that time there was very little rainfall on the base and only a rare anopheline mosquito was found. However, of 55 primary cases occurring in the base personnel from January to June 1945, 44 had been to some nearby native community for at least 1 evening, 2 to 4 weeks prior to the onset of the symptoms. The rest had visited these places previously. The potential danger of these communities as sources of malaria is patent. Also of possible significance in the increased rate was the institution late in 1944 of routine malaria smear on all dispensary admissions and in most out-patients. It is believed that many cases were thereby properly diagnosed as malaria that might have otherwise been overlooked.

SUMMARY

1. The incidence of malaria at Guantanamo Bay, Cuba, from 1930 to November 1945 has been reviewed.
2. The species types have been listed and the great predominance of *P. falciparum* infections has been pointed out.
3. Although 2 deaths have occurred in a series of 169 cases of *P. falciparum* infection, the majority of these cases had mild symptoms. It has been emphasized that many atypical, mild manifestations, especially of respiratory or gastro-intestinal nature, occur in this type of malaria.
4. The importance of carriers, service personnel as well as native, has been pointed out, and the role of the routine malaria smear in detecting them is stressed.
5. A summary of malaria control measures at the base is presented.

REFERENCES

1. CARR, H. P., FERNANDEZ MELENDEZ, J., and Ros, A.: Malaria reconnaissance of Province of Oriente in Cuba. *Am. J. Trop. Med.* 20: 81-97, January 1940.
2. BROWN, O. J. and WARE, R. L.: Observations on mosquito and malarial control in Caribbean area. *U. S. Nav. M. Bull.* 39: 614-631, October 1941.
3. CARR, H. P. and HILL, R. B.: Malaria survey of Cuba. *Am. J. Trop. Med.* 22: 587-607, November 1942.

4. SIMPSON, W. M., LEAKE, W. H., McMAHON, A., GUDEX, T. V., and RUECKERT, R. R.: Experiences with malaria at an advanced base in South Pacific: Report of 4,647 admissions at —. U. S. Nav. M. Bull. 41: 1588-1595, November 1943.
5. METCALF, R. J. and UNGAR, J., JR.: Relapsing malaria: Analysis of cases from Solomons. U. S. Nav. M. Bull. 43: 859-870, November 1944.
6. APPLEBAUM, I. L. and SHRAGER, J.: Pneumonitis associated with malaria. Arch. Int. Med. 74: 155-162, September 1944.
7. CASTELLANI, A.: Malaria Simulating Various Other Diseases Including Certain Surgical Conditions. J. Trop. Med. and Hyg. 33: 357-364, December 1, 1930.
8. DANIEL, R. A., JR.: Malaria simulating acute surgical diseases of the abdomen. Ann. Surg. 111: 436-445, March, 1940.
9. MANSON-BAHR, P. H.: Malaria in wartime. Brit. M. J. 2: 461, October 17, 1942; 489, October 24, 1942.
10. EDITORIAL: Gastro-intestinal diseases in Navy. U. S. Nav. M. Bull. 42: 470-471, February, 1944.
11. HUGHES, S. B.; and BOMFORD, R. R.: Clinical features and treatment of malaria in British troops in West Africa. Brit. M. J. 1: 69-73, January 15, 1944.
12. MERRILL, B. R.: Psychogenic malaria. U. S. Nav. M. Bull. 44: 69-72, January, 1945.
13. BIRKS, P. H.: Symptomatology of malaria. Brit. M. J. 1: 748-785, June 26, 1943.
14. WEATHERSBEE, A. A.: Observations on relative attractiveness of men and horses for anopheles albimanus Weidman. Am. J. Trop. Med. 24: 25-28, January, 1944.
15. PETTCHARD, A. E.; and PRATT, H. D.: Comparison of light trap and animal bait trap anopheline mosquito collections in Puerto Rico; list of mosquitoes of Puerto Rico. Pub. Health Rep. 59: 221-233, February 18, 1944.
16. CASE RECORD 6922, Dispensary, Naval Station, U. S. Naval Operating Base, Guantanamo Bay, Cuba: Comment by BROWN, C. J., Captain (MC) U. S. N.
17. BARBER, J. F.: Preliminary report on malaria in combat zone. U. S. Nav. M. Bull. 41: 977-979, July, 1943.

NOTES ON NAVAL RESERVE CONTRIBUTORS

Amberson, Julius M., Commander (MC) USNR (*Schistosomiasis and Its Control in Egypt*, p. 977). E. M., Montana School of Mines, 1921; M. D., Rush Medical College, 1927. Intern, 1926-27, and attending surgeon, 1927-42, Norwegian-American Hospital, Chicago, Ill.; private practice, Chicago, 1927-42. Fellow American Medical Association; member: Illinois State Medical Society, Chicago Medical Society, and American Public Health Association.

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- Curry, Howard J.**, Lieutenant (DC) USNR (*Replacement of Missing Teeth of Acrylic Dentures in the Field*, p. 1118). D. D. S., Kansas City-Western Dental College, 1943. Member American Dental Association.
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- Fitzgerald, Patrick J.**, Lieutenant (MC) USNR (*Malaria at a Caribbean Base*, p. 1140). B. S., Massachusetts State College, 1936; M. D., Tufts College Medical School, 1940. Intern, Boston City Hospital, 1940-41; resident and assistant pathologist, Mallory Institute of Pathology, Boston City Hospital, 1942-43, 1946-. Member Massachusetts Medical Society. Fellow American Medical Association. Diplomate National Board of Medical Examiners.
- Henry, Merlyn G.**, Commander (MC) USNR (*Emergency Surgical Measures Aboard an APA During an Amphibious Invasion*, p. 1057). B. A., 1926, and M. S., 1927, University of Wisconsin; M. D., Rush Medical College, 1929. Instructor in Physiology, University of Illinois College of Medicine, 1927-29; intern, 1930, and junior attending surgeon, 1933-40, Los Angeles County Hospital, Los Angeles, Calif.; resident surgeon, Presbyterian Hospital, Chicago, and teaching fellow in surgery, Rush Medical College, 1931-32; instructor in surgery, University of Southern California School of Medicine, 1933-39; first assistant in surgery to Dr. C. T. Sturgeon, Los Angeles, 1933-36; medical director and chief surgeon, Bureau of Water and Power of the City of Los Angeles, 1934-40; staff member, Hospital of the Good Samaritan, Los Angeles, 1933-. Fellow: American Medical Association and American College of Surgeons; member: Los Angeles County Medical Association and California Medical Association. Diplomate National Board of Medical Examiners.
- Lane, Frederick E.**, Lieutenant Commander (MC) USNR (*The Ambulance Boat*, p. 1124). A. B., Columbia College, 1928; M. D., Columbia University College of Physicians and Surgeons, 1932. Intern, Jewish Hospital, Brooklyn, N. Y., 1932-37; private practice, Brooklyn, 1937-; assistant in obstetrics and gynecology, Kings County Hospital, Brooklyn, N. Y. Member: New York County Medical Society, Brooklyn Gynecological Society, and American Medical Association. Diplomate American Board of Obstetrics and Gynecology.
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- Mallory, George D., Jr.**, Lieutenant Commander (DC) USNR (*Alginate Impression Technique*, p. 1083). B. S., University of California, 1941; D. D. S., College of Dentistry, University of California, 1943. Intern, dental prosthesis and surgery, Agnews State Hospital, Santa Clara, California, 1943-1944. Member: American Dental Association, California State Dental Association, Alameda County Dental Society, and American Society of Dentistry for Children.

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McMaster, Paul E., Commander (MC) USNR (*Prespondylolisthesis*, p. 1077). A. B., Morningside College; B. S., University of South Dakota; M. D., Rush Medical College, 1928. Intern, Presbyterian Hospital, Chicago, 1928–29; resident in orthopedics, University of Chicago Clinics, 1930–33; private practice, orthopedic surgery, Los Angeles, 1933–; assistant clinical professor in orthopedic surgery, University of Southern California School of Medicine, 1933–; fracture training under Prof. Lorenz Böhler, Vienna, 1936; attending staff: Hospital of the Good Samaritan, Children's Hospital, Cedars of Lebanon Hospital, Los Angeles, Hollywood-Presbyterian Hospital, and Los Angeles General Hospital, Los Angeles, Calif. Fellow: American Medical Association and American Academy of Orthopaedic Surgeons; member: Western Orthopaedic Association, California Medical Association, and Los Angeles Surgical Society. Diplomate American Board of Orthopaedic Surgery.

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Snell, Albert M., Captain (MC) USNR (*Some Clinical Problems of Amebiasis*, p. 1023). B. S., University of Minnesota, 1915; M. D., 1918, and M. S. 1927, University of Minnesota Medical School. House officer on medical service, University of Minnesota Hospital, Minneapolis, Minn., Jan.-June 1918; Intern, U. S. Naval Hospital, Great Lakes, Ill., June 1918-Feb. 1919; private practice, Mankato Clinic, Mankato, Minn., March 1920-Feb. 1924; head of section in medicine, Mayo Clinic, Rochester, Minn., 1929-41; attending physician, St. Marys Hospital and Colonial Hospital, Rochester, Minn., 1927-41; professor of medicine, University of Minnesota Graduate School (Mayo Foundation), 1940-. Fellow: American Medical Association and American College of Physicians; member: American Gastro-Enterological Association, Association of American Physicians, Minnesota Academy of Medicine, Minnesota Society of Internal Medicine, American Society for Clinical Investigation, Central Society for Clinical Research (president, 1932), and American Society for Experimental Pathology. Diplomate American Board of Internal Medicine. Coauthor, *Diseases of the Gall-bladder and Bile Ducts*, W. B. Saunders Co., Philadelphia, Pa., 1940; and *Vitamin K*, W. B. Saunders Co., Philadelphia, 1941.

Sternstein, Herman J., Commander (MC) USNR (*Management of Common Eye, Ear, Nose and Throat Conditions in Naval Practice*, p. 1041). B. S. Tufts College, 1923; M. D., Tufts College Medical School, 1927. Intern, Carney Hospital, Boston, Mass., May 1927-Nov. 1928; assistant resident and resident, otolaryngology, Kings County Hospital, Brooklyn, N. Y., 1930-31; post-graduate study, otolaryngology, Harvard Post-Graduate Medical School, 1931; private practice, Boston, 1931; instructor, otolaryngology, Tufts College Medical School, 1936-; staff, Massachusetts Eye and Ear Infirmary, Boston Dispensary, and Beth Israel Hospital, Boston. Fellow American Medical Association; member: Massachusetts Medical Society and New England Otological and Laryngological Society. Diplomate American Board of Otolaryngology.

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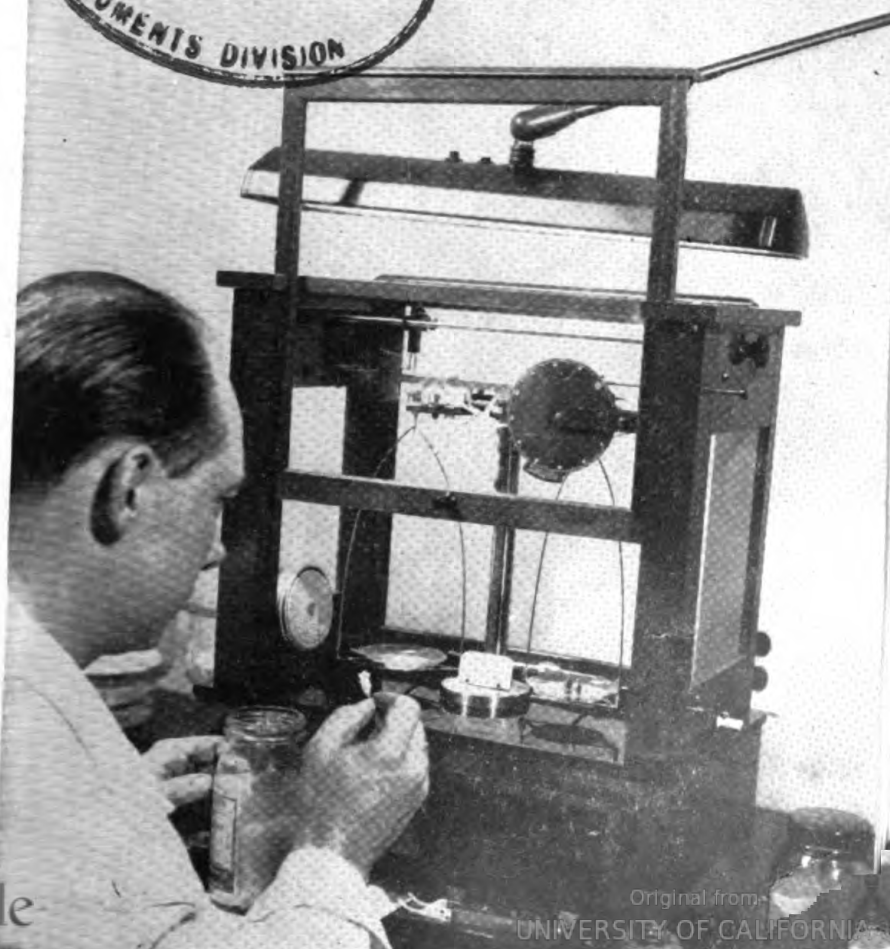
NUMBER 8



AUGUST 1946

BUREAU OF
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WASHINGTON, D. C.

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**Using a delicate analytical balance in
the General Chemistry Laboratory in
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NAVY DEPARTMENT,
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This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

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With the establishment of the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of that Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

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ROSS T McINTIRE,
Surgeon General, United States Navy.

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SPECIAL ARTICLES

THE NAVAL MEDICAL SCHOOL IN 1946 ¹

H. L. PUGH

Captain (MC) U. S. N.

The establishment of a U. S. Naval Medical School was advocated in 1809 by Surgeon W. P. C. Barton, U. S. Navy, who, in September 1842, became the first Chief of the Bureau of Medicine and Surgery. What fate befell Dr. Barton's original recommendation is not clear from the records beyond the fact that nothing came of it unless to it can be attributed the requirement in an Act of Congress approved in 1828 that candidates for appointment as assistant surgeons and surgeons be examined and approved by a board of naval surgeons. History has it that in the early 1870's, a couple of medical directors of the U. S. Navy were sent at different times to Europe to visit medical establishments and to report upon medical education abroad. In 1873 and again in 1874, a school to instruct assistant surgeons was recommended by Surgeon General Joseph Beale but it was not until 1877-78 that, at the direction of Surgeon General William Grier, a course of formal instruction for junior medical officers of the Navy was inaugurated at the U. S. Naval Hospital, Brooklyn, N. Y. The curriculum extended over a period of 2 years. In 1893, however, nearly 100 years after Dr. Barton's initial proposal, Surgeon General J. R. Tryon issued an order creating an instructional course of 3 months' duration at the U. S. Naval Laboratory and Department of Instruction at New York City. This is regarded as the first bona fide U. S. Naval Medical school and it is interesting to note that the original British

¹ This article is adapted from an address delivered before the first post-World War II class of officers of the Naval Medical Corps assigned to a Basic Refresher Course at the U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md., 7 January 1946.

Naval Medical School at Haslar Hospital near Portsmouth, England antedated the United States school only 10 years. Dr. Tryon's school continued to operate in New York City until 1898 when, owing to the Spanish-American War and a consequent shortage of officers, it was closed. In 1902, at the instance of Surgeon General P. M. Rixey, it was reopened in Washington, D. C., at Twenty-third and E Streets NW., where it functioned uninterruptedly for 40 years. Navy Department General Order No. 70 of 1 June 1935 directed the establishment of the Naval Medical Center at Washington, D. C., to consist of the Naval Medical School and the Naval hospital. On 17 March 1936 the Naval Dental School, Washington, D. C., became a unit of the Naval Medical Center. The naval medical facilities under the cognizance of the Bureau of Medicine and Surgery that were being completed at Bethesda, Md. in 1942 were established by order of the Secretary of the Navy as the National Naval Medical Center, Bethesda, Md., effective 5 February 1942. The Naval Medical School is now a unit of that center.

The Naval Medical School is fundamentally a postgraduate institution, but at present it encompasses a number of special activities. Its chief mission in peacetime has been the training of medical officers of the Navy for service ashore and afloat with special emphasis upon certain phases and branches of medicine and surgery of particular importance and peculiar to the Navy. During the late war, it was a foremost function of the school to train classes of officers and enlisted personnel, both male and female, in various specialties of timely importance incident to the war and to its geographical theatres of operation. These specialties were epidemiology and tropical medicine, malariology, laboratory procedures, pathology, roentgenology and photofluorography, the painting of acrylic eyes and the several aspects of art and photography which are together grouped under the heading of audio-visual educational aids.

The general laboratories, which perform a highly important and essential function for the naval hospital, are all within the Naval Medical School. In fact these laboratories serve as a court of last resort for the Navy at large in instances where a local laboratory of a naval hospital or dispensary desires corroboration or assistance. They consist of those assigned to entomology, parasitology, hematology, serology, bacteriology, pathology, epidemiology, enteric pathogens, biologics, physiological chemistry, general chemistry, pharmacy and chemistry, blood collecting, and blood and plasma. Toxicological examinations upon autopsy material in cases where death occurred under extraordinary circumstances throughout the Navy are done in the general chemistry laboratory of the Naval Medical School. The

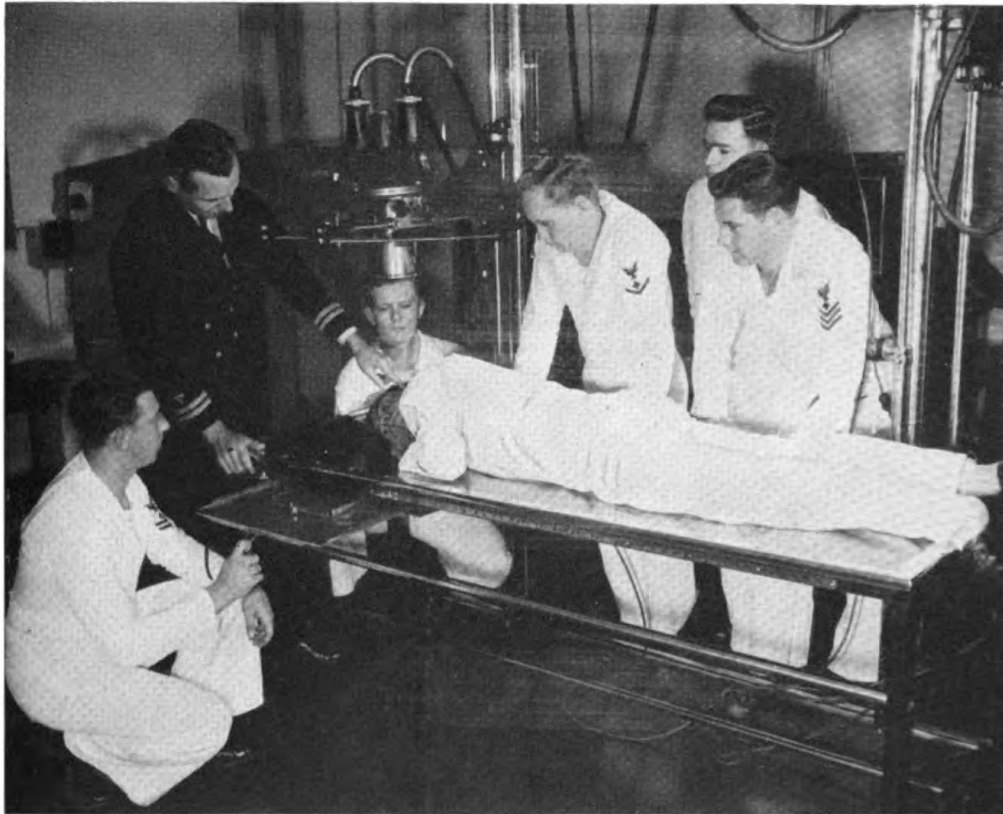


1. A demonstration to students by the head of the department of pharmacy and chemistry.

morgue for the hospital at Bethesda is within the Naval Medical School and all autopsies performed there are done by the school's pathologists.

The Naval Medical School maintains administrative guidance over a number of additional extracurricular activities. For administrative purposes as regards both personnel and property accounting, the blood and blood plasma department is a unit of the Naval Medical School. The Naval Medical School manufactures certain biologicals including Kahn antigen and colloidal gold for the entire Navy. Both the crew's library of the naval hospital, which contains 7,000 books, and the National Naval Medical Center library consisting of approximately 32,000 medical books, journals, pamphlets, etc., come within the purview of the Naval Medical School's administration.

The duplicating department of the Medical Center is a Naval Medical School activity. Several research endeavors including the enteric pathogen and streptococcic typing departments functioned within the Naval Medical School during the war years. However, these two departments were recently transferred to the Naval Medical Research Institute, another unit of the National Naval Medical Center.



2. Instruction of enlisted men in roentgenology and photofluorography.

To add to the diversification of interests and activities which operate under the banner of the Naval Medical School, there must be included the legal assistance department for the whole Medical Center and the board room which handles matters pertaining to the physical and professional examination of officer candidates for the Naval Medical Corps and which, moreover, is the facility whose function it is to take care of the physical examinations for members of the Federal Bureau of Investigation and prospective White House employees. Through this service to the FBI a spirit of cordiality on the part of that organization towards the Naval Medical School has been engendered and is being covetously maintained.

The class which began 7 January 1946 marked the revival of a basic training course for naval medical officers. It is contemplated that similar classes will convene regularly, that the course will be of 5 months' duration and will be designed as an indoctrination or a refresher course depending upon the indication. A refresher motif was emphasized in the first post-World War II course which covered 840 hours as follows:

<i>Subject</i>	<i>Hours</i>	<i>Subject</i>	<i>Hours</i>
Preventive medicine and hygiene	207	Medical-Department duties	10
Exotic diseases	138	Physical medicine	10
Surgery	108	Dermatology (including mycology and syphilology)	7
Medicine	79	Proctology	6
Neuropsychiatry	66	Industrial hygiene	6
Courts and boards	33	Aviation medicine	6
Urology	22	Nutrition	4
Eye, ear, nose, and throat	21	Chemical warfare	3
Physiological chemistry	19	Visit to Research Institute	3
X-ray	16	Visit to National Institute of Health	2
Cardiology	15	Toxicology	1
Atmospheric hygiene (including oxygen therapy and resuscitation)	15	Instruction in use of medical library	1
Serology	15		
Pathology	15		
Hematology	12	Total hours	840

To supplement its curriculum a series of guest lectures is sponsored by the Naval Medical School. Effort is made to obtain, at least at monthly intervals, guest lecturers especially familiar with a particular subject regarded as of timely importance. These are evening lectures and are held in the Center auditorium. The follow-



3. Scene in hematology laboratory.

ing comprised the guest-lecture program for the first post-World War II Basic Course:

31 January 1946.—Dr. Richard A. Kern, Commodore (MC), U. S. N. R. (inactive). University of Pennsylvania, Philadelphia. Subject: The Principles of Treatment of Allergic States.

28 February 1946.—Captain Shields Warren (MC), U. S. N. R. Head of recent U. S. Naval Technical Mission to Investigate the Physiological Effects of the Atom Bomb. Subject: Medical Aspects of the Atom Bombs at Hiroshima and Nagasaki.

28 March 1946.—Commander Julius M. Amberson (MC), U. S. N. R. Recently Officer in Charge of a U. S. Naval Epidemiological Unit in Egypt, the Levant, and India. Subject: Epidemiological Experiences in the Near and Far East.

25 April 1946.—Dr. Frank H. Krusen. Head of the Section on Physical Medicine, The Mayo Clinic, Rochester, Minn. Subject: The Expanding Field of Physical Medicine.

23 May 1946.—Dr. Foster Kennedy. Medical College of Cornell University, New York City. Subject: Neurology as Psychosomatic Medicine.

In addition to conducting this Basic Training Course for medical officers, the school will continue to conduct a course in pathology and in photofluorographic interpretation for officers and courses in

pharmacy and chemistry, laboratory technique, x-ray and photo-fluorography, photography, physical medicine, and medical illustration for enlisted personnel.

Throughout its long history the Naval Medical School has leaned heavily upon the staff of the U. S. Naval Hospital for a part of its instructors in the basic courses for officers. There has always been a close and cordial relationship between the staffs of the school and the hospital and the renewal of this relationship is a gratifying realization. The Naval Medical Research



4. Using micro-melting point apparatus in general laboratory.

Institute has come into existence since the beginning of the war; consequently the association of its staff with that of the Naval Medical School has been limited but the closer relationship with it and the various other staffs of the Center, for which the re-institution of the course in basic training for naval medical officers constitutes an opportunity, is a wholesome thing. Thus the teaching staff is well balanced and colorful. It contains grizzled veterans from all theaters of war who have been seasoned by service aboard various types of naval craft and at various spots ashore. Some are veterans of two wars.

The Navy gave a glorious account of itself in the late war. The Medical Corps' performance was scarcely equalled and certainly not excelled by any other branch. Its epidemiology and malariology teams were sent to the farflung corners of the earth. They functioned in every continent. In numerous instances their work was more vitally instrumental in making beachheads tenable than was the gunfire of our combatants. The personnel of the Naval Medical Corps stands eye to eye with any other department or division of the naval service. It was the fortune of a number of the members of the faculty as well as of trainees of the Medical School to render outstanding service during the late war. Several have been decorated for performances of an exceptionally meritorious character. Several have received the Purple Heart.

While, by reason of the war, the staff of the Naval Medical School contained and still does contain a number of very erudite individuals, for whom we are grateful, we are moreover proud to be associated with and have here and in the Bureau of Medicine and Surgery or peripheral medical activities as our good counsellors and friends, a number of the able and valued members of the school's staff of former years.

A matter of the most immediate concern to prospective members of new classes for basic training for officers will naturally be the course and its curriculum. A great deal of care and thought are devoted to the fashioning and formulation of the curriculum with due regard being given to whether an indoctrination or refresher element should be emphasized. Such emphasis is determined, of course, by the kind of personnel that will comprise a class in a given instance. Effort is made to make the curriculum as inclusive and as comprehensive as is possible commensurate with an avoidance of so diluting it as to make it valueless.

When it is considered that the Navy transports medical officers over thousands of miles and maintains a carefully selected faculty and devotes the choicest space in its number one medical institution to the instruction of students, assignment to this school for a course of instruction is not to be regarded lightly; it is decidedly something

more than a gesture. Credit for having completed a basic course at the Naval Medical School has for many years been regarded as standard equipment for a full-fledged medical officer of the regular Navy. In the prewar era when, owing to limited facilities at the old medical school, the classes were necessarily small; it was not uncommon for an officer to have been in the service up to 10 years and occasionally longer before being assigned to a course in the school. In any event, such assignment has always been sought after and regarded as a fortunate circumstance.

The design of the officers' basic course at the Naval Medical School is manifold. In addition to the mission of training medical officers of the Navy in certain phases and branches of medicine and surgery of particular importance and peculiar to the Navy both ashore and afloat, the basic course of the Naval Medical School is intended to provide the medical officer with an opportunity to correct his deficiencies and to fortify himself in such respects as he has become aware weakness exists and to guide and assist in this respect. It is the school's aim to better equip the medical officer for the dual function of a naval officer and a doctor, for to be what is expected of him, he must be both. An effort is made in the formulation of the curriculum to provide the young medical officer with fundamental knowledge on certain subjects strictly peculiar to the service. For instance, in the first post-World War II course, 33 hours were devoted to Courts and Boards. It is important for a medical officer to have at least a fundamental knowledge of matters of this kind because, whether he likes it or not, he is certain to find himself a member of a board before he has been in the service very long and he is expected to know the score. The axiom that no matter how brilliant a fielder or how fast a runner a baseball player may be, he is only one-half a player if he cannot throw and hit the ball, is ever held up to naval medical officers as a good motto and one particularly applicable to them.

A number of the students who are ordered here will have previously submitted an application for a postgraduate course of instruction at some civilian institution. The fact that such an applicant has been ordered here does not mean that he will not ultimately get his postgraduate course. However, much will depend upon two circumstances, first, when and for how long the officer's services can be spared, and second, the need for a particular kind of specialist. How well the officer applies himself here and the kind of showing he makes will very definitely have a bearing upon his prospects for subsequent postgraduate training. Attendance on the course here may well be regarded as a kind of proving ground and while it may not be feasible to make the basic course a prerequisite for all postgraduate

courses in civilian institutions, it may be so considered in a goodly number of cases. One or two students have expressed concern lest the Navy may be wasting their time by requiring them to take this course when they could be following what they think is their specialty or even that they should be engaged in a special postgraduate course of their private liking. Our advice to these officers is that they disabuse their minds of this idea as promptly as possible lest the bureau trump such an idea with one of its own that the investment of public funds to provide postgraduate instruction for an officer so opinionated would indeed be a mistake. Students are urged to take advantage of their every opportunity to gain as much knowledge and competency in the component subjects of their course as is possible. Benjamin Franklin said it would be well if students "could be taught everything that is useful and everything that is ornamental but art is long and time is short. It is therefore proposed that they learn those things that are likely to be most useful."

The teaching may be streamlined but knowledge can always be acquired by those who make the effort. Lectures, demonstrations, and laboratory work should be augmented by the use of the library which is operated on a very liberal schedule. That one will get out of an instructional course proportionately as he puts into it is a truth too obvious to warrant further comment. In any event, a certificate signed by the medical officer in command of the Naval Medical School and by the Surgeon General of the Navy attesting the satisfactory completion of a course at this institution, is equivalent to an endorsement of the holder of such a certificate by the school and by the Bureau of Medicine and Surgery. It is hoped that each student receiving such a certificate will have clearly merited it and that he will, in years to come, so serve his corps and the naval service, as to reflect creditably upon this school and to justify the time and effort expended by the Navy in his behalf.

A very detailed and accurate record of grades made by each student in all subjects is kept in the permanent archives of the Naval Medical School. Each student upon graduation is given a slip bearing the grades made by him during the course, and the three top members of each class are designated. Both faculty and students are enjoined, however, to be ever mindful that the excellence of a doctor is not measured solely by a flair on the part of the individual to answer stock questions correctly but rather by his ability to observe accurately, think clearly, reason soundly, and act wisely.

Steps are being taken in an endeavor to obtain from the various professional boards, credit for the work performed in the Naval Medical School's basic course toward their requirements for board recognition.

The road ahead is uncertain but an added interest is inherent because of that uncertainty which offers a fascinating challenge. Of one thing there is no question, it will devolve upon the youthful medical officers of today and those who will enter the field in the future to fashion and fit themselves into the scheme of things yet to be determined. It may require a period of several years before the dust and debris and confusion have cleared sufficiently for us to see not only what our place in the post-World War II world will be but, indeed,



5. Group of officers in Basic Refresher Course at work in epidemiology laboratory.

in which direction the road leading to it lies. It will be the heritage of those who are just beginning their ascent up the ladder to find out—to find the answer—rather than those who shall soon be ready to start their descent. It is to be hoped that the descent of some will at least not interfere with the ascent of others.

Human nature likes to ascribe some special significance to rainbows, rings around the moon, and numerous other phenomena of nature. The proneness of little whirlwinds to spring up in the ashes left by some conflagration is a common observation. Sometimes these whirlwinds are of only a brief duration and fluff out. Sometimes they are multiple and when they coalesce, a whirlwind of formidable proportions is evolved. Whether or not any special significance is

supposed, by those superstitiously inclined, to attach to this interesting manifestation is not known. Only its predilection to occur where there has been a conflagration, disintegration, and ashes is known. The ashes of the late war's desolation, literally and figuratively, lie as mute evidence of history's greatest exhibition of man's inhumanity to man and in these ashes, as was inevitable, spontaneous and sporadic eddies and whirlwinds of social unrest and turbulence have appeared and will undoubtedly for some time continue to appear.

The justification for our share in the responsibility for the creation of those ashes is not a point at issue. It will probably remain for those who come after us a century hence to pass judgment upon that question.

We of the medical profession need not necessarily be concerned. Our course prior to, during, and following all wars has been the same. The forces, the very substance of a nation, become fairly well divided into two categories whenever war in its natural turn assumes the ascendancy. One of the forces "marches to the drum beat's roll, the wide-mouthed clarion's bray." The inscription on its crimson scroll attests that its glory is to destroy. But the precepts of the doctor are diametrically opposed to the aims of that force. The mission of the force of which the doctor is a leading disciple is not proclaimed by blood-red pennons but rather by a banner which by a single line attests that "our duty is to save."

And so, if the whirlwinds which are springing up today do coalesce and reach mammoth proportions, as seems not improbable, it will devolve upon our young doctors, indeed it will become their duty and privilege, to ride that whirlwind. It is a leading purpose of the Naval Medical School to better prepare doctors of the Navy for such an eventuality and it is our hope that if and when they are called upon, they will ride the whirlwind skillfully and wisely and well, and that good fortune will ride with them.



CYTOTOXICITY OF STREPTOMYCIN AND STREPTOTHRICIN

Several different preparations of streptomycin were tested on cultures of rabbit's spleen and were found to have a uniformly low toxicity for wandering cells and fibroblasts. Streptothricin had a relatively low cytotoxicity for leukocytes and macrophages but showed a fairly high cytotoxicity for fibroblasts.—HEILMAN, D. H.: Cytotoxicity of streptomycin and streptothricin. *Proc. Soc. Exper. Biol. & Med.* 60: 365-367, December 1945.

A RAPID METHOD FOR DETERMINING METHYL ALCOHOL IN THE BLOOD AND BODY FLUIDS

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Lieutenant (HC) U. S. N.

Wood alcohol continues to be widely used as a beverage either by design or in ignorance and the resulting acute poisoning demands quick and often heroic treatment. Because even the fatal cases may not develop alarming symptoms for some hours after drinking methyl alcohol but may survive for from 24 hours to several days, there is urgent need for a rapid, simple blood test for methyl alcohol in order that early treatment may be instituted. In this article such a test is described and it should be run in conjunction with every positive test for ethyl alcohol in the blood for only in that way will the salvage rate of unsuspected cases of methyl-alcohol poisoning be increased. The need for such a regime is obvious to the many medical officers who have dealt with methyl-alcohol poisoning during the war.

The blood test for ethyl alcohol currently used by the Navy does not distinguish between ethyl and methyl alcohol. It is a fact that methyl alcohol alone in the blood will give positive results with the current test for ethyl alcohol so that unsuspected cases of methyl-alcohol poisoning may be wrongly diagnosed as simply run-of-the-mill acute ethyl alcoholism.

The test to be described is sensitive, specific, easily done in the Navy laboratory, and the required reagents are stable and readily obtained. It will detect as little as 1 microgram in 1 milliliter of water and easily detected as little as two-tenths milligrams of methyl alcohol in 1 cubic centimeter of blood.

METHOD OF TEST

Reagents.—(1) Sodium bisulfite, NaHSO_3 , reagent grade. (2) Chromotropic acid, 1,8 dihydroxynaphthalene 3,6-disulfonic acid, (Eastman Kodak Co. No. 1613). (3) Potassium permanganate mixture, 15 grams of KMnO_4 , 75 ml. of 85-percent phosphoric acid, H_3PO_4 , and sufficient distilled water to make 500 ml. (4) 20-percent

trichloroacetic acid, 20 grams of trichloroacetic acid crystals and sufficient distilled water to make 100 ml. Keep in refrigerator. (5) Concentrated sulfuric acid, reagent grade.

PROCEDURE

(1) To 2 ml. of oxalated blood in a 50-ml. Erlenmeyer flask, add slowly with shaking 2 ml. of 20-percent trichloroacetic acid. Stopper and shake well for 1 minute.

(2) Pour into a 15-ml. centrifuge tube and whirl for 5 minutes at 2,000 rpm.

(3) If supernatant is clear, carefully pipet 1 ml. into a small test tube. If not clear, pour through small No. 42 Whatman filter paper and use 1 ml. of filtrate.

(4) Add 0.2 ml. of the permanganate reagent and let stand 1 minute, shaking gently from time to time.

(5) Add solid powdered sodium bisulfite, using just enough to completely decolorize the permanganate and also to decolorize any brown manganese dioxide that is formed. (This amount of sodium bisulfite is usually about 10 milligrams and the amount which will just cover the butt end of any ordinary pencil will usually suffice.)

(6) Add chromotropic acid powder and shake gently. (The amount of chromotropic acid which can be lifted on the end of an ordinary safety match is sufficient.)

(7) Add 1.5 ml. of sulfuric acid, tilting the tube and allowing the acid to flow down the sides of the tube so that it forms a separate layer underneath the solution. At this point, carefully examine the junction between the aqueous solution and the underlying sulfuric acid. If methyl alcohol is present, a purple ring will be seen at this junction.

(8) Cautiously mix the contents of the tube by gently swirling and let stand until cold. If methyl alcohol is present, a diffuse violet color will be produced, the intensity of which will be proportional to the concentration of methyl alcohol. Blood filtrates having no methyl alcohol give a light brown tint.

Those using the test should run several known positives and negatives to familiarize themselves with the procedure and colors. Whenever possible, control positives and negatives should be run with each unknown.

DISCUSSION

Most procedures for the detection of methyl alcohol depend on its oxidation to formaldehyde and the method described in this paper is no exception. The formaldehyde is usually determined colorimetrically by Schiff's reagent which is a solution of rosaniline decolorized by sulfurous acid in some form. This reagent has the disadvantage of being unstable, and pure quality standard rosaniline is difficult to obtain. Chromotropic acid and sodium bisulfite, both solids, are stable and easily procured in pure form. The advantages of these reagents over Schiff's reagent are obvious. The concentrated sulfuric acid provides sufficient heat for the color reaction and vitiates the need for

a water bath. (The use of sulfuric acid in this connection was suggested by the laboratories of the Alcohol Tax Unit, Bureau of Internal Revenue, Washington, D. C.)

Finally, the test is more specific than that with Schiff's reagent and the color produced is more stable,¹ persisting 48 hours or more.

In a recent fatal case of methyl alcohol poisoning studied in this laboratory a weighed amount of the liver (2 grams) was minced and substituted for blood in the above method. The qualitative presence of methyl alcohol was easily detected. The quantitative figure for the liver in this case obtained by the distillation method was 0.4 milligrams of methyl alcohol per gram. For further confirmation, two experimental animals were given a mixture of 3 ml. of absolute methyl alcohol and 7 ml. of distilled water, one by the intravenous route, the other intraperitoneally. The blood in each case was strongly positive 5 hours later by this method. The quantitative values on the blood of these animals was 0.5 milligram per milligram of whole blood in each case and the above dosage was nonfatal.

The use of this test on urine, vomitus, gastric contents, and suspected beverages² should offer no difficulty. Stomach contents may be obtained and tested whenever possible, even after several days have elapsed since the suspected beverage was taken, for methyl alcohol appears to be resecreted into the stomach.

Should there be doubt concerning contamination of the suspected material by formaldehyde, this may be detected by omitting the oxidation with permanganate and decolorization with bisulfite. Merely adding the chromotropic acid and sulfuric acid is sufficient to develop a color in the presence of formaldehyde. If this test is positive, any further tests for methyl alcohol will be useless.

The following substances were tested for their possible interference in this test for methyl alcohol: Ethyl alcohol, acetone, sodium formate, aspirin, phenacetin, acetanilid, sodium barbital, sodium amytal, phenobarbital, nembutal, seconal, procaine hydrochloride, cocaine hydrochloride, caffeine, atropine, quinine, atabrine, nicotine, chloral hydrate, salicylic acid, sulfanilamide, sulfapyridine, sulfathiazole, and sulfadiazine. None gave a positive test immediately although nicotine, codeine, and quinine gave a positive upon standing overnight. Old solutions of cocaine, however, did give a positive test, while fresh solutions did not.

Methenamine (urotropin) gives an intense positive as would be expected. However, it also gives a positive reaction without oxida-

¹ BRICKER, C. E. and JOHNSON, H. R.: Spectrophotometric method for determining formaldehyde. *Indust. & Engin. Chem. (Anal. Ed.)* 17: 400-402, June 1945.

² *The Pharmacopoeia of the United States of America*. 12th edition. Mack Printing Co., Easton, Pa., 1942. p. 428.

tion by permanganate and reduction by bisulfite and this would be detected in the test for formaldehyde. Indeed, it is felt that methenamine could be used as a convenient standard solution for the quantitative estimation of methyl alcohol, as 0.729 gram of methenamine should liberate the amount of formaldehyde that is produced by 1 gram of methyl alcohol upon oxidation.

The quantitative estimation is beyond the scope of this paper but it would be necessary to resort to distillation to eliminate the brown tint produced in a blank. It may also be added that distillation methods may be used where available and time permits for the qualitative detection of methyl alcohol.

SUMMARY

A rapid, specific, and sensitive method for the detection of methyl alcohol in blood and body fluids is presented. The test should be performed routinely on all bloods that are positive for ethyl alcohol because the present Navy test does not distinguish between methyl and ethyl alcohol.

ACKNOWLEDGMENT.—The helpful advice and cooperation of Lt. Comdr. S. P. Hicks (MC) U. S. N., Lts. C. O. Edge and E. R. Aaron (HC) U. S. N. in bringing this work to completion is acknowledged.



TRAUMA AND TUBERCULOSIS

Traumatic injury is able only to activate a tuberculous process in a tissue which beforehand has a certain disposition for tuberculosis. In some cases, presumably, the trauma plays an essential role in the appearance of a tuberculous focus in such a tissue; in other cases it probably acts merely as the drop that makes the cup overflow. So, the coincidence of trauma and tubercle is by no means sufficient for the production of a tuberculous focus. Other conditions, which might be designated as favorable local immunobiological conditions, have to be present if the trauma is to exert its effect in this respect. It is most likely that traumatic injury really may play an essential part in the production of the tuberculous lesion.

The tuberculosis process is always localized to the same regions as spontaneous tuberculosis. If, for instance, the traumatic injury hits a knee joint, the result will never be a skin tuberculosis in the knee regions but always a tuberculous process in the knee joint itself, in keeping with the fact that tuberculosis of the skin of the extremities is a very rare lesion, whereas tuberculosis of the knee joint is relatively frequent.—MEYER, J.: Trauma and tuberculosis. *Acta path. et microbiol. scandinav.* 21: 571-586, April 1944.

INJECTION OF IODIZED OIL AS AN AID TO CLOSURE OF DRAINING SINUSES

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It is the purpose of this article to call attention to the fact that chronic draining sinuses frequently close following the injection of iodized oil. It has long been recognized that sinuses sometimes close following the injection of such material as bismuth paste or iodized oil, and no claim of originality is made for these observations. But the incidence of draining sinuses is so high in war wounds and the hospitalization associated with either expectant treatment or radical surgery designed to close these sinuses is so protracted that it is believed many hospital days will be saved by reminding the profession of a method of treatment that will often hasten the closure of such sinuses.

An unrecognized sinus is one of the commonest causes of failure of a wound to heal. If the granulations remain gray and edematous and are bathed in pus, a sinus is probably present. This will be covered with edematous granulations and can be discovered only by probing. It is important that these sinuses be recognized and treated as soon as possible.

When a sinus persists for several weeks, one must always suspect that it contains foreign material, enters a hollow viscus (fecal fistula), or is kept open by the presence of a poorly drained abscess cavity or a piece of infected bone. When the drainage is profuse the presence of a nonmetallic foreign body or a piece of necrotic bone is probable. There should be no delay in investigating the cause of the persistent drainage.

After the presence of the sinus is established, a roentgenogram should be made to rule out the presence of osteomyelitis, sequestra, or metallic foreign bodies. If these are not present, iodized oil should be injected under the fluoroscope and the tract filled. Roentgenograms are then made either stereoscopically or from both anterior-posterior and lateral angles to determine the extent of the tract. No attempt is made to retain the oil in the wound. If the x-rays show no obvious cause for the persistence of the sinus, there is a better than even chance that the sinus will close within 1 or 2 days of the time of

the injection of the oil and remain closed. If the drainage persists, it is often worth while to give penicillin, both locally and systemically, and, after 2 days, to reinject the sinus with iodized oil. The penicillin is given for 2 days more, and in many instances closure of the sinus will ensue.

The iodized oil often remains in the tissues for several months and can be demonstrated by x-ray despite the fact that the sinus is closed and the patient is free of symptoms. Eventually it is probably absorbed.

During the past year approximately 20 large sinuses have closed following the injection of iodized oil. The following case reports are typical.¹

CASE REPORTS

Case 1.—Age 19 years. Gunshot wound of left flank 2 months previously; small amount of purulent drainage from a sinus which admitted probe 10 cm. Penicillin, 50,000 units every 4 hours for 2 days. X-ray following injection of iodized oil shows sinus extending anteriorly and medially. No foreign body or abscess cavity. Wound healed the day following injection of oil.

Case 2.—Age 25 years. Gunshot wound of abdomen 5 months previously. Exploratory laparotomy done soon after injury and some of metal removed. Wound had drained purulent material ever since operation in spite of treatment with penicillin. Sinus tract was then injected with "Diotrast" showing a tract 20 cm. long ascending to the sub-diaphragmatic region on the right, where there was a pocket 3.5 by 6 cm. in size. Penicillin was given intramuscularly in doses of 20,000 units 4 times a day, and 20,000 units were injected into the cavity daily. At the end of 1 week the sinus closed and has remained so.

Case 3.—Age 22 years. Osteomyelitis of sacroiliac region of 4 years' duration following injury by airplane propeller. Draining sinus posteriorly communicating with rectum through the pelvic bones. Colostomy done 7



1. Sinus closed soon after injection of iodized oil.

¹ The oil used in this series of cases was Pantopaque, made by the Eastman Kodak Co.

months before to control infection from rectum, but in spite of this and the administration of penicillin, the drainage persisted. Iodized oil was injected into the sinus, following which it drained much less and within 1 week was closed and has remained so (fig. 1).

Case 4.—Age 23 years. Appendectomy for perforated appendix 2 months before. Localized peritonitis and a fecal fistula developed. Infection subsided on treatment with penicillin, but a draining sinus persisted. After injection of iodized oil, roentgenograms proved that the fistula entered the cecum. No further drainage after injection of oil, and fistula has remained closed.

Case 5.—Age 26 years. Gunshot wound of abdomen 3 months previously. Kidney and spleen damaged and spleen removed. Persistent draining sinus through mid-portion of abdominal wound. Sinus injected with iodized oil and found to extend posteriorly and to the right for a distance of 10 cm. ending in a pocket 6 by 2 by 2 cm. in size. Sinus was closed on the day following injection and has drained no more.

Case 6.—Age 35 years. Postoperative duodenal fistula with peritonitis; treated with penicillin. Fistula closed but pelvic abscess 6 cm by 3 cm. persisted for 6 weeks and drained through upper abdominal incision, total length of tract being 22 cm. Drainage diminished after injection of iodized oil and the sinus closed 1 week later.

Case 7.—Age 19 years. Gunshot wound of thigh 4 months previously. Fragment entered mid-thigh and went upward, fracturing the ischial tuberosity and entering the pelvis. Colostomy had been performed. X-ray showed sequestra



2. (Case 7). Long sinus extending upward to pelvis and containing fragments of necrotic bone.



3. (Case 7). Same sinus after removal of bone. Sinus persisted until iodized oil again injected, then promptly closed.

at site of fracture. Roentgenograms following the injection of iodized oil showed tract 37 cm. long extending from mid-thigh upward through the site of fracture and into the pelvis (fig. 2). Drainage persisted and a conservative operation was performed. The mouth of the sinus was enlarged and several pieces of necrotic bone were removed with a long forceps. Fifty thousand units of penicillin were given every 4 hours, but drainage persisted for 3 weeks until iodized oil was again injected into the tract. The pelvic portion of the tract did not fill on this occasion and the sinus stopped just above the site of the fracture (fig. 3). Drainage stopped on the day following the injection. Fifty thousand units of penicillin were given every 4 hours for 2 days. The sinus closed and has remained so.

Case 8.—Age 18 years. Appendectomy for ruptured appendix 5 months previously. Pelvic abscess persisted and was inadequately drained through a sinus extending upward through the incision. Roentgenograms following injection of iodized oil showed a pelvic abscess 2.5 cm. in diameter. Treatment with penicillin both locally and intramuscularly failed to diminish the drainage. The tract was opened and the cavity explored but no foreign body was found. In spite of better drainage and repeated irrigations the discharge persisted. A second injection of iodized oil 2 months after the first showed persistence of the sinus as before, but the abscess was now only 1.5 cm. in diameter (fig. 4). Following the injection of oil the drainage diminished and the sinus promptly closed and remained so.



4. Pelvic abscess draining through appendectomy incision. Drainage ceased 24 hours after injection of iodized oil.

SUMMARY

The injection of iodized oil into chronic draining sinuses is frequently followed by prompt healing provided foreign bodies are not present.

Penicillin given systemically before and after the injection of iodized oil has helped to control infection and promote healing.

TROPICAL ACNE^{1 2}

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There is nothing new in the statement that life in the Tropics is "bad for the skin"; and it is well known that, particularly under military conditions, many men in the Tropics suffer from such dermatoses as fungous infections, pyodermas, "eczemas" and prickly heat. It is, therefore, not astonishing that skin diseases have caused a great deal of disability among military personnel in the Tropics. Thus, in military hospitals on Guam as high as 10 percent of all hospitalized cases consist of skin diseases; and from 60 to 70 percent of all men responding ambulatorily to sick call do so because of skin affections. While these figures are high and impressive, they are not out of line with the expected incidence of dermatoses in the Tropics.

Recent observations and an analysis of the dermatologic cases, however, have brought to light an unexpected fact. Approximately 20 percent of the dermatoses are "acnes"! This is indeed astonishing in view of the universal observation that most cases of ordinary acne seen in temperate climates tend to improve during the summer and in warm weather. The unexpectedly high incidence of acne in military personnel on tropical duty has impelled us to submit this report of the findings in a random series of 51 consecutive military cases of "acne" studied by us during August 1945 on the island of Guam.

¹From U. S. Naval Medical Research Unit No. 2, Capt. Thomas M. Rivers (MC) U. S. N. R., Medical Officer in Command.

²This article is being published simultaneously in the Bulletin of the U. S. Army Medical Department.

CLINICAL DESCRIPTION

The picture presented by these cases is that of an acne, not of furunculosis, folliculitis, impetigo, or any other pyoderma. Although furuncles and furunculoid lesions may be present, the characteristic lesions of acne dominate the picture. There are blackheads, papules, nodules, pustules, cysts, and very often scarring. The fundamental local process appears to be identical with that seen in the more severe forms of cystic acne in temperate climates.

Despite the basic similarity with acne vulgaris, the condition differs from ordinary adolescent acne in the following significant respects:

1. *Age of patients.*—The disease often appears in men well past the usual age for the onset of acne vulgaris. Instead of being largely confined to adolescents, men in their twenties and thirties are frequently affected. In 25, or about one half, of our cases the present eruption began at over 20 years of age, and in 7 of the 25 there were neither history nor signs of preceding acne vulgaris (table 1).

2. *Localization of lesions.*—The lesions tend to involve many areas usually free in typical acne vulgaris. Thus, in contrast to acne vulgaris, the arms and forearms, abdomen, lower back, buttocks, thighs, and neck are quite commonly affected. In numerous cases one or more of the areas enumerated are severely involved while the face remains relatively free. Several typical and active lesions or scars on the extensors of the forearms just distal to the elbows, over the hips, on buttocks or upper thighs, with relative absence of lesions on the face, suggest a "tropical" form of acne (table 1 and figs. 1 and 2).

3. *Nodules, cysts, and scars.*—Nodules, cysts, and scars are much more uniformly present and more pronounced than in any series of unselected patients with acne vulgaris. Quite commonly deep cysts and oozing of pus and blood incapacitate the patients. Very often the clothing, bedding and other gear are constantly soiled with blood and pus. Moreover, the nodular and cystic lesions become so large and tender that they preclude military duty. Riding in a jeep, carrying a pack and other military routines are attended by difficulty and pain. The scarring often leads to great, and of course permanent, disfigurement.

4. *Effects of climate.*—In almost all instances heat and humidity, and sometimes exposure to sun, seem to aggravate the condition. So long as the patient remains in the Tropics, orthodox therapy is often ineffectual or produces only partial or temporary benefit. On the other hand, removal of the patient to a cool dry environment often brings about rapid improvement. The disease is considered a tropical one in that the environmental factors encountered in the humid Tropics



1. Showing the severe scarring and the distribution on arms, forearms, buttocks, and thighs.

undoubtedly play a role in its genesis and prolongation.³ Because the disease is progressive in the Tropics, because it causes considerable discomfort and impairment of function, and because it leaves permanent disfigurement, the question of evacuation to cooler and dryer climates must be seriously weighed in each case. If the services of the patient can be dispensed with he should be returned to a cool dry climate as early as possible.

5. *Can it be predicted which men will be likely to acquire "tropical acne" and which will not?*—As this dermatosis is one of the major causes of loss of effectiveness of personnel in the humid Tropics, the answer to the above question is obviously important. It is our present considered opinion that there are no criteria which will reliably indicate all men who will or will not be subject to tropical acne. As shown in table 1, many of the patients have had no signs or history of severe acne before entering tropical duty. And conversely we have seen many men with moderate or severe acne, or with a history of such, who have not developed "tropical acne" while on duty in this theater. Numerous patients having active acne when entering the tropics either have remained unchanged or have improved.

Despite these facts it is our impression that men who have severe acne while in temperate zones are somewhat more inclined to tropical acne than are those with no history of acne. In this regard, a tendency to widespread acne with cyst formation, or the presence of an excessively oily skin, or any other signs of hyperactivity or dysfunction of the sebaceous apparatus may be assumed to be indicative of potential "tropical acne." It would, therefore, appear advisable, whenever feasible, not to send men with such manifestations into the Tropics.

6. *Pathogenesis.*—Our observations have convinced us that, while poor personal hygiene, dirt, poor washing facilities, and inadequate living and dietary conditions as well as exogenous or endogenous cutaneous infections may play some role, they are not the primary or major causes of tropical acne. The dermatosis is seen almost as frequently in those who have lived under the best conditions as in those who have suffered the deprivations of combat and field conditions. Just as in acne vulgaris, the basic pathologic process appears to be overactivity of the sebaceous glands with plugging of their ducts and orifices. Continued heat and humidity, plus unknown local and constitutional factors, are evidently sufficient to bring about the essential pathologic change.

In this connection it is to be recalled that several authors have alluded to the fact that even in the temperate zones heat and sunlight

³It is probable that excessive heat and sweating similarly tend to bring on the well known acne in stokers, the "black gang," and those who work for long periods in any very hot and humid environment.



2. Front view of patient shown in figure 1. Note that face is very oily but relatively free of acne lesions.

make some cases of acne vulgaris worse instead of better. The most likely hypothesis is that heat stimulates both the sebaceous and the sweat glands and that moisture and maceration, as well as hyperkeratosis following sunlight, may lead to a plugging of glandular ducts in some persons and in some areas of skin.

Table 1 summarizes the findings in 51 patients which form the basis of this report.

TABLE 1.—*Tropical acne*

A. Age:	
Number of cases.....	51
Average age at time of examination (years).....	23.9
Average age at onset of present eruption (years).....	22.0
Range of age at onset (years).....	16-37.0
Number of cases above 20 years at onset.....	25
B. History and/or signs of previous acne vulgaris:	
No history or signs.....	24
Mild or moderate previous acne.....	25
Severe previous acne.....	2
Total with evidence of previous acne.....	27
Number of cases with onset at over 20 years and no previous acne....	7
Number of cases with onset at over 20 years and evidence of previous acne.....	18
C. Localizations: Number of times involved in 51 cases examined:	
Face.....	14
Back.....	42
Buttocks and/or thighs.....	16
Chest and/or abdomen.....	35
Arms and/or forearms.....	25
Neck (posterior, anterior, and/or lateral).....	24

In an evaluation of the figures in table 1 the following facts must be borne in mind:

1. While the average age of onset of 22 years does not appear old, it is well beyond the usual age of onset of acne vulgaris. Moreover, the average age of onset could not well be higher in our series, since the military population from which our cases are drawn consists almost exclusively of young men. We have seen sufficient cases beginning in men in their thirties to convince us that "tropical" acne can commence at any period of adult life.

2. The figures given for the history or evidence of previous acne are susceptible to two main sources of error. First, many of the men tend to deny previous acne, in that they wish to have their skin condition attributed to the effects of military service. Second, it is a normal finding to elicit history or evidence of previous mild acne in the majority of young men free of skin trouble. These two influences tend to balance each other. This, coupled with the fact that there was not a very high incidence of objective signs of previous acne (scars, keloids, pits, etc.), has led us to the conclusion that pre-

vious severe acne vulgaris is not necessarily a precursor of "tropical acne."

3. The incidence with which the various sites were affected not only demonstrates the differences between the localizations of this dermatosis and those of acne vulgaris, but even suggests that the areas previously the site of acne vulgaris may be relatively resistant to tropical acne. Thus, the face, which is by all odds the most commonly involved site in acne vulgaris, was affected in only 14 of our 51 patients. While the neck, the arms and forearms, and buttocks and thighs, all of which are rarely the sites of acne vulgaris, were involved 24, 25, and 16 times, respectively, in the 51 cases of tropical acne. Indeed, in 2 cases the buttocks and thighs, i. e., the areas covered by shorts, were the only parts affected.

SUMMARY AND CONCLUSIONS

1. A certain variant of acne vulgaris is described. It has a high incidence and is a great cause of discomfort and loss of effectiveness among military personnel in humid tropics.

2. This form of acne differs from adolescent acne vulgaris in several significant respects, namely, its age of onset, its principle localizations, and its course.

3. It is brought on or made worse by heat and high humidity and tends to improve when the patients are removed to a cool, dry environment.

4. While poor personal hygiene, diet, local factors, and infection may play some role—as in acne vulgaris—the occlusion of the ducts of hyperactive sebaceous glands seems to be the essential pathologic process.

5. Because of its differences from acne vulgaris and because it is of such common occurrence and is apparently brought on or made worse by conditions found in humid Tropics, the designation of "tropical acne" is applied to this condition.

6. The findings in a random group of 51 consecutive cases of "tropical acne" are presented in tabular form and are discussed.

ARTIFICIAL TEETH IN NAVY DENTAL PROSTHETICS

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Recent accounting of artificial teeth expended for Navy dental prosthetics produced some interesting proportions which have proven useful in determining new orders and in restocking. The following analysis may be helpful to others engaged with similar order problems. A sample of approximately 5,500 patients is presented here as being a convenient yardstick for activities either larger or smaller. Studies of two smaller prosthetic units revealed figures of relatively parallel proportions.

Table No. 1 is a breakdown of 8,598 dentures completed for 5,576 men and is representative of the source activity over an 8-month period from June 1944 to January 1945, inclusive. During this time essential prosthetic replacements were made largely for young recruits. Samples indicated that 50 to 75 percent were 18 or 19 years old. Of the total group 78 to 86 percent were less than 31 years old. The remaining 14 to 22 percent beyond 30 years of age was composed mainly of men in service prior to the war, of specialists, or of officers.

The ages of these recruits were, as a whole, lower than those of the recruits composing the first drafts in the present war. Ratios of partial dentures to full dentures ranged from 1 to 1, to as high as 4 to 1. Such ratios supported the obvious conclusion that prosthetic patients of lowest age groups require more partial than full dentures. Generally speaking, increased proportions of partial dentures place an increased burden upon technicians especially, but less upon dental officers. On the other hand, increased full dentures place an increase of effort largely upon dental officers and to a lesser extent upon technicians.

It is worthy of note that notwithstanding the change in ratio of partials to fulls from time to time, the average patient continued to require approximately one and one-half dentures, and the average denture required slightly more than one and one-half sets of teeth.

Men accepted for prosthetic treatment represented about 8 percent of the total recruits. However, the number treated was determined by limitation of prosthetic capacity rather than by actual need. From time to time it had been necessary to send drafts of men to other naval activities for prosthetic treatment even when selection had been based upon minimum prosthetic requirements.

The figures and percentages of distribution of posterior teeth as shown in table No. 2¹ follow a familiar pattern. The ratio of upper to lower sets of anterior teeth differs somewhat from civilian experience which dealt with patients not only older but restricted by financial and social levels. A large number of broken-down anterior teeth extracted and replaced during recruit training would in civilian life be either neglected or if extracted would not be replaced.

Table No. 3 lists 3,191 sets of anterior teeth according to their frequency of selection. Eighty percent of all sets issued were from the first ten molds. Open-purchase allotment during this period was not sufficient to permit adequate stocking of all molds. The present Navy assortment provided a substantial portion of the tooth supply. Irrespective of the influence these factors undoubtedly had upon actual percentages the chart does reflect the unquestioned popularity of certain molds.

Table No. 4 shows that of a total of 5,884 sets of posteriors there is a heavy distribution of teeth in medium- and short-bite molds. The short-bite molds would undoubtedly be greater in number if there had been at all times a greater stock of short-bite teeth. The use of an increasingly larger number of acrylic posteriors for cases of limited interalveolar space has further diluted short-bite proportions. Obviously the loss of teeth in the mouths of young patients has been due more to the disease of teeth rather than to the disease of alveolar process.

Table No. 5 is a record of the numbers and percentages of the 7 shades used. Eighty-four percent of all sets issued were among the lighter shades with shade 67 the most commonly used. This is undoubtedly attributable to the youth of the patients under treatment.

Table No. 6 is a composite presentation of the total sets of teeth identified as to mold, shade, and number of sets. This record may be of assistance in making out orders for prosthetic installations in the field concerned with similar replacement problems.

It is well to bear in mind that specific prosthetic needs are largely determined by the age groups encountered. Present data support the general observation that when working from a minimum stand-

¹ Although the figures for totals in tables 2, 4, 5, and 6 are not in agreement, in view of the length of time since they were prepared and the relatively small amount of disagreement the tables are published without corrections.

ard, older age groups require more dentures, more full and less partial dentures. Conversely, younger age groups require less dentures, greater proportions of partial dentures and less of fulls.

Percentages presented in these charts may under somewhat different conditions require revision. However, even the present data may be useful to other activities in proportional stocking of appropriate molds, shades, and number of porcelain sets of teeth.

TABLE 1.—*Cases completed (8-month period)*

	Number	Percent of total
Full uppers.....	1,928	22
Full lowers.....	686	8
Partial uppers.....	2,598	30
Partial lowers.....	3,386	40
Total.....	8,498	100

TABLE 2.—*Distribution of sets*

Anteriors			Posteriors			Anteriors and posteriors		
Location	Number	Percent	Location	Number	Percent	Location	Number	Percent
Upper.....	2,405	75	Upper.....	3,052	52	Upper anterior.....	2,405	26
Lower.....	786	25	Lower.....	2,832	48	Lower anterior.....	786	9
						Upper posterior.....	3,052	34
						Lower posterior.....	2,832	31
Total.....	3,191	100		5,884	100		9,075	100

TABLE 3.—*Molds (numbers and percentages) selected in 3,191 sets of anterior teeth*

Mold	Number	Percent	Mold	Number	Percent	Mold	Number	Percent
3N.....	518	16	1ES.....	53	1.7	234.....	10	0.31
2N.....	386	12	5P.....	44	1.4	335.....	10	.31
3P.....	364	11	154.....	28	.88	222.....	9	.28
3D.....	354	11	3M.....	26	.82	274.....	7	.21
2P.....	284	9	1R.....	25	.78	276.....	7	.21
1N.....	221	7	275.....	25	.78	1P.....	5	.16
A25.....	161	5	4E.....	21	.66	265.....	4	.13
225.....			1Y.....	19	.59	343.....	3	.09
4H.....	135	4	2D.....	17	.53	3C.....	2	.06
2E.....	106	3.3	17.....	17	.53	223.....	2	.06
A26.....	82	2.6	1X.....	14	.43	333.....	2	.06
1E.....	79	2.5	3Y.....	13	.40	A84.....	1	.03
2C.....	73	2.3	1D.....	10	.31	135.....	1	.03
1H.....	53	1.7						

TABLE 4.—*Mold distribution in 5,884 sets of posterior teeth*

Mold.....	31M	31S	33M	31L	29L	33S	29S	33L	Total
Uppers.....	1,703	356	319	287	194	64	54	66	3,043
Lowers.....	1,605	422	298	193	167	62	56	38	2,841
Total combined.....	3,308	778	617	480	361	126	110	104	5,884
Percent.....	56.2	13.2	10.5	8.1	6.2	2.1	1.9	1.8	100

TABLE 5.—*Shade distribution by number and percent*

Shade.....	65		66		67		69		73		77		81		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Anteriors:																
Upper.....	495	20.6	397	16.5	726	30.2	500	20.8	81	3.4	135	5.6	71	2.9	2,405	100
Lower.....	131	16.6	107	13.6	267	34.0	187	23.8	12	1.5	53	6.7	29	3.5	786	100
Total.....	626	19.6	504	15.8	993	31.1	687	21.5	93	2.9	188	5.9	100	3.2	3,191	100
Posteriors:																
Upper.....	568	18.6	532	17.4	903	29.6	536	17.6	135	4.4	232	7.6	146	4.8	3,052	100
Lower.....	479	17.0	431	15.2	878	31.0	508	17.9	137	4.8	243	8.6	156	5.5	2,832	100
Total.....	1,047	17.8	963	16.4	1,781	30.2	1,034	17.6	272	4.6	475	8.1	302	5.3	5,884	100
Anteriors and posteriors:																
Upper.....	1,063	19.5	929	17.0	1,629	29.9	1,036	19.0	216	3.9	367	6.7	217	4.0	5,457	100
Lower.....	610	16.9	538	14.9	1,145	31.6	695	19.2	149	4.1	296	8.2	185	5.1	3,618	100
Total.....	1,673	18.4	1,467	16.2	2,774	30.6	1,731	19.1	365	4	663	7.3	402	4.4	9,075	100

TABLE 6.—Composite chart of 9,052 sets of teeth providing 5,576 men with 8,598 dentures

UPPER ANTERIORS Total, 2,404																
Mold	SHADE							Mold	SHADE							Total
	(Percent of total in shade and number in shade in mold)								(Percent of total in shade and number in shade in mold)							
	65 (21%)	66 (17%)	67 (30%)	69 (21%)	73 (3%)	77 (5%)	81 (3%)		Total	65 (21%)	66 (17%)	67 (30%)	69 (21%)	73 (3%)	77 (5%)		81 (3%)
3N	78	63	111	78	11	21	11	373	IV	3	2	6	3			1
3P	61	49	87	61	9	13	9	289	266	3	2	6	3			1
2N	54	43	77	54	8	13	8	257	210	3	2	5	3			1
3D	50	40	71	50	7	12	7	237	IX	3	2	4	2			1
2P	44	36	63	44	6	11	6	210	3Y	2	2	4	2			1
1N	34	29	49	34	5	8	5	164	110	2	1	3	2			
A25	28	22	39	28	4	6	4	131	222	2	1	3	2			
255									234	2	1	3	1			
4H	22	18	31	22	3	5	3	104	335	2	1	2	2			
2E	16	13	22	16	2	4	2	75	276	1	1	2	1			
A26	15	12	20	15	2	4	2	70	274	1	1	2	1			
2C	13	11	20	13	2	3	2	64	1P	1	1	2				
1E	13	10	19	13	2	3	2	62	265	1	1	2				
1ES	10	8	14	10	2	3	2	49	343	1	1	1				
5P	9	7	12	9	2	3	2	44	3C	1	1	1				
11H	7	6	7	11	2	3	2	38	223	1	1	1				
3M	5	3	7	5	1	2	2	24	333							
275	5	2	7	5	1	2	1	23	284							
154	5	2	7	5	1	1	1	22	135							
1R	3	2	6	3	1	1	1	17								
4E	3	2	6	3	1	1	1	17								

TABLE 6.—Composite chart of 9,052 sets of teeth providing 5,576 men with 8,598 dentures—Continued

LOWER ANTERIORS
Total 764

Mold	SHADE							Mold	SHADE							Total
	(Percent of total in shade and number in shade in mold)								(Percent of total in shade and number in shade in mold)							
	65 (17%)	66 (14%)	67 (34%)	69 (24%)	73 (2%)	77 (6%)	81 (3%)		65 (17%)	66 (14%)	67 (34%)	69 (24%)	73 (2%)	77 (6%)	81 (3%)	
3N	24	20	49	35	3	9	4	33	1	1	2	1				6
2N	22	18	44	31	2	8	4	1ES	1		2	1				5
3D	19	17	40	28	2	7	4	4E	1		2	1				5
3P	13	10	26	18	2	4	2	335								
2P	13	10	25	18	1	4	2	265			2	1		1		5
A84								25								
1N	10	8	19	14	1	3	2	21D			1					2
A25								275								1
225								45			1					1
24	6	5	12	8	1	2	1	44			1					2
34								266								1
4H	5	4	11	7	1	2	1	26			1					1
2E	5	4	11	7	1	2	1	47			1					1
1E	3	2	6	4		1	1	1D			1					1
1H	3	2	5	4		1		22			1					1
1R	1	1	3	2		1		276			1					1
								46								1
								23			1					1

UPPER POSTERIOBS Total 3,043										LOWER POSTERIOBS Total 2,841									
Mold	SHADE (Percent of total in shade and number in shade in mold)								Total	Mold	SHADE (Percent of total in shade and number in shade in mold)								Total
	65	66	67	68	73	77	81	65			66	67	69	73	77	81			
	(19%)	(17%)	(30%)	(17%)	(4%)	(8%)	(5%)	(17%)			(15%)	(32%)	(18%)	(4%)	(9%)	(5%)			
31M	324	289	511	290	68	136	85	1,703	31M	273	241	514	289	64	144	80	1,605		
31S	69	60	107	60	14	28	18	356	31S	72	63	135	76	17	38	21	422		
33M	60	54	96	54	13	26	16	319	33M	51	45	95	54	12	26	15	268		
33L	54	49	87	49	11	23	14	287	33L	33	29	62	35	8	17	9	193		
29L	36	33	58	33	8	16	10	194	29L	33	28	64	30	7	15	8	167		
33L	12	11	20	11	3	6	3	66	33S	11	9	20	11	2	6	3	62		
33S	12	11	19	11	2	6	3	64	33S	10	8	18	10	2	5	3	56		
29S	11	9	17	9	2	4	2	54	33L	7	6	12	7	1	3	2	58		

DENTURES COMPLETED						
Number	Percent of total	Type				Totals
		Full uppers	Full lowers	Partial uppers	Partial lowers	
8,598	100	1,928	686	2,598	3,386	
		22	8	30	40	

BRONCHIECTASIS

A Clinical Analysis of 39 Cases

JOSEPH J. WITT

Commander (MC) U. S. N. R.

Bronchiectasis is a chronic disease characterized by enlargement of bronchial lumina. Infection is usually associated with it. Any part of one or both lungs may be involved. The diagnosis is established by lipiodol bronchography.

With respect to diagnosis, bronchiectasis occupies the same place today that tuberculosis occupied a half-century ago. At that time, when the patient had prolonged fever, emaciation, severe cough, much expectoration, pleurisy and hemoptysis, he was said to have tuberculosis, or consumption. At the present time all physicians recognize that tuberculosis can be present and active without any of these symptoms of advanced disease.

All physicians are familiar with the textbook picture of the patient with advanced bronchiectasis who for years has been going about with his chronic cough productive of copious, foul, purulent sputum, and who at intervals is confined to bed because a hemoptysis of variable severity, an attack of pleurisy, or pneumonia. Such a patient usually has extensive abnormal physical signs over one or both lungs, clubbing of the fingers and toes, cyanosis of the nail beds, chronic sinusitis, extensive abnormal x-ray shadows at the bases of the lungs, and extensive saccular or cystic bronchiectasis easily demonstrable by lipiodol bronchography.

Like tuberculosis, bronchiectasis can be present with few or none of the manifestations of advanced disease. Few physicians are familiar with the patient who has little or no cough, a little odorless sputum, or even none, no clubbing nor cyanosis, slight and indefinite or even no abnormal x-ray shadows, and yet a definite bronchiectasis demonstrable by lipiodol bronchography.

The group of 39 cases included in this report is unusual because of the relatively large number of patients with minimal bronchiectasis, i. e.: Patients with minimal bronchial dilatations, in whom symptoms, signs, and abnormalities demonstrable by ordinary x-ray exami-

nations were minimal or absent. These patients¹ were observed at a naval hospital, during the period from February 1943 to July 1944. Several additional cases observed in the latter part of that period are not included because their records are not at hand. The cases reported represent about 40 percent of the patients studied because they were suspected of having bronchiectasis. The clinical analysis of the cases observed follows.

TABLE 1.—*Length of service prior to present admission*

	Cases
Less than 1 month.....	21
1-3 months.....	10
4-6 months.....	1
7-12 months.....	3
1-2 years.....	2
3-4 years.....	1
Record not at hand.....	1

Length of service prior to present admission.—A number of these men had one or more previous admissions to the sick list for respiratory disease. The large number of cases in the group with less than 1 month of service reflects the fact that this hospital draws most of its patients from a naval training center where enlisted men receive their first naval or "boot" training. At the same time it is interesting to note how soon after their exposure in barracks to the widely disseminated respiratory pathogens, many of these men develop an illness which leads to the recognition of their bronchiectasis.

TABLE 2.—*Age*

	Cases
Under 21 years.....	24
21-25 years.....	3
26-30 years.....	2
31-35 years.....	3
36-40 years.....	5
Record not at hand.....	2

Age.—The preponderance of cases in the youngest age group is explained by the fact that the greater number of men in training at this time were under 21.

Time of diagnosis.—Neither of the two men in whom the diagnosis of bronchiectasis was made in civilian life was asked direct questions as to the existence of bronchiectasis at the time of induction. They did not volunteer the information, because they thought the x-ray would surely reveal their disease. One of the cases diagnosed on reporting

¹All except four of these patients were observed personally by the author and were studied in collaboration with Comdr. J. Gershon-Cohen (MC), U. S. N. R., roentgenologist and Comdr. John R. Myers (MC) U. S. N. R., of the eye, ear, nose, and throat department.

for duty was suspected of having bronchiectasis on the basis of findings in the 35-mm. photofluoroscopic film.

TABLE 3.—*Time of diagnosis*

Place	Cases
In civilian life	2
On reporting for first duty	2
After admission to a naval hospital for some other cause.....	35

Past history.—Thirty-one of the thirty-nine patients gave a past history of significant respiratory disease. In addition, four others as children were delicate, and one of these was kept out of school for an entire year. One patient had had repeated attacks of fever, the cause of which was not determined.

TABLE 4.—*Past history*

Illness ¹	Cases
Pneumonia (1 or more attacks).....	16
Frequent "chest colds".....	6
Chronic cough and expectoration.....	7
Dry pleurisy.....	2
Empyema drainage.....	2
Asthma.....	2
Lung tumor.....	1
Hemoptysis.....	3
Severe diphtheria.....	1
Tracheotomy.....	1
Sinusitis, chronic.....	5

¹ Several patients had had more than 1 illness.

The importance of taking a careful history to determine the frequency of previous respiratory infections cannot be overemphasized as a lead in the diagnosis of bronchiectasis. In most cases the bronchiectasis is acquired, and usually develops in the course of a severe pulmonary infection. Such an infection may occur any time after birth, and many cases of bronchiectasis have their inception in infancy and early childhood. Once the bronchiectasis has developed, cough and expectoration may continue forever afterward. On the other hand, the infection may subside but the structural changes remain. In either case, the individual is subject to superimposed infection or to reactivation of latent infection from time to time, manifest as pneumonia, bronchitis, etc.

Admission diagnosis.—All of the diagnoses of catarrhal fever were later changed to pneumonia.

Bronchiectasis may form a background for any respiratory disease. It follows that when confronted with an individual with a history of repeated episodes of respiratory disease, the clinician may well ask himself: "Does this patient also have bronchiectasis?"

TABLE 5.—*Admission diagnosis*

Diagnosis	Cases
Pneumonia (all varieties)	11
Catarrhal fever, acute	11
Bronchitis:	
Acute	2
Chronic	1
Bronchiectasis	5
Asthma	2
Tuberculosis	3
Lung tumor	1
Scarlet fever	1
Hemorrhoids	2

Symptoms.—Sufficient data is not at hand to discuss this heading fully. However, 3 patients had hemoptysis while under observation, and 8 others are known to have had blood-streaked or blood-tinged sputum. Blood-streaked or blood-tinged sputum is a common finding in uncomplicated pneumonia. Gross hemoptysis, on the other hand, when occurring during the course of a pneumonia, should excite a suspicion of the presence of bronchiectasis. Bronchiectasis should always be considered in the differential diagnosis of gross hemoptysis. It should be considered also in the differential diagnosis of chest pain, be it mild or severe.

Cough and expectoration are the most constant symptoms observed. Occasionally a patient has no cough or expectoration. Not infrequently a patient will deny having these symptoms, yet will be observed to cough; in such a case pus may be obtained following postural drainage. Foul sputum is seldom present except in advanced cases. Only one of our patients had foul sputum, and this condition was of only 2 weeks' duration. Malaise, weakness, and anorexia are common complaints.

Physical signs.—Fever was present during the acute respiratory infections for which most of these patients were admitted. Slow and irregular return of the temperature to normal was the rule. Recurrence of fever with acute flare-ups of pulmonary infection was common. Persistent tachycardia was pronounced in one patient following an acute respiratory infection which developed while he was at home on leave. The pulse returned to normal within a few days after starting postural drainage. Slight clubbing of fingers was present in two patients. Mild cyanosis was present in those with clubbing. The general nutrition was usually fairly good. Several patients appeared to be chronically ill, but most did not.

Every one of these patients had râles, usually persistent, at some time during the period of observation. In some, the râles disappeared prior to discharge from the hospital. Râles were most frequently of the medium or moderately coarse variety. However, sibilant râles,

rhonchi, and wheezes were frequently heard over the involved lobe, and at times also over lobes that showed no bronchiectatic change. This latter finding is explained on the basis of intrapulmonary drainage and bronchitis. It may be well at this point to quote Jackson's famous aphorism: "All is not asthma that wheezes."

Postural drainage.—The amount of pus was usually less than 90 cc. daily. The pus was frequently of a thick, homogenous, dirty greenish character. During treatment it usually diminished in amount, became thinner, often changed from green to yellow in color, and at times became mucoid. In some cases the sputum practically disappeared.

TABLE 6.—*Postural drainage*

Character of drainage	Cases
Pus.....	36
Mucus.....	1
Not recorded.....	2

Postural drainage is one of the simplest, most important, and most neglected of all diagnostic procedures. Requiring no special equipment and but a few minutes to perform it can be done anywhere, and often gives sufficient information on which to make a tentative diagnosis of bronchiectasis, even when a careful roentgenographic examination of the chest is negative. Postural drainage should be a routine diagnostic procedure whenever a patient has chronic cough, whenever a pneumonia fails to clear promptly, or whenever râles are observed at the bases of the lungs. This procedure has definite therapeutic value also. Most patients with bronchiectasis will improve if postural drainage is carried out regularly, even in the absence of other therapeutic measures.

X-ray findings prior to bronchography.—In most of these cases, the roentgenologist suspected the presence of bronchiectasis. The study of serial roentgenograms was of great value..

TABLE 7.—*X-ray diagnoses prior to bronchography*

X-ray findings	Cases
Incomplete resolution of pneumonia.....	15
Persistent bronchitis.....	8
Definite bronchiectasis.....	5
Moderate interstitial fibrosis.....	3
Post-pneumonic atelectasis.....	2
Lung tumor, benign.....	1
Negative.....	5

Bronchography.—This procedure is necessary to establish the diagnosis of bronchiectasis. In it the chest is x-rayed after the instillation of an opaque oil into the bronchi. Various techniques may be used

for introducing the oil. Lipiodol (Lafay) was used in all of our cases, but Iodochloral (Searle) also is very satisfactory. The localization of the lesion can be accomplished by x-rays taken in the antero-posterior and lateral positions, and at times oblique views are useful. Bronchography is not complete until both lungs are entirely mapped. This may be done at one sitting, but it is better to map only one lung or parts of both lungs at one time. One or two weeks should elapse between mappings. Excess oil should be evacuated by postural drainage after satisfactory roentgenograms have been obtained. The bronchiectatic lung eliminates the oil more quickly and more completely than does the normal lung. Most of the oil is eliminated (expectorated) from the lungs within 2 weeks, but x-ray evidence of small residues of oil may be noted several years later. In no instance have any ill effects been observed from retained oil.

Bronchography not only is necessary for establishing a diagnosis of bronchiectasis, but also is necessary for the proper management of the patient with this disease. Surgical removal of a lobe or lobes is the treatment of choice in selected cases, but no surgical program should be undertaken without a previous complete mapping of both lungs.

Types of bronchiectasis.—The one striking thing about this group of cases is the great number with minimal disease. In these, the bronchiectatic changes, although definite, were slight, so that when we first began to recognize this type of case, we wondered if the changes noted might be only temporary. Mindful of the reversible changes which at times occur in bronchi distal to foreign bodies, we kept a number of these patients under observation and repeated the bronchographic studies after a period of from 6 weeks to 3 months. In no case did the changes noted in the original examination disappear; in several cases, however, the bronchiectasis appeared to be less marked than in the original examination.

TABLE 8.—*Types of bronchiectasis*

Type	Cases
Minimal cylindrical.....	21
Moderate cylindrical.....	2
Advanced cylindrical.....	1
Cylindrical and fusiform.....	7
Cylindrical and cystic.....	2
Fusiform.....	2
Cystic.....	2
Saccular.....	1
Unclassified.....	1

Various hypotheses were offered to explain the enlarged bronchial lumina on a basis other than the obvious one of bronchiectasis. It was suggested that the pressure of the oil overlying "retained sec-

tions" might be distending the bronchi mechanically. Yet when only enough oil was in the bronchi to coat the mucosa rather than to fill the lumen, the same dilatation was seen. This observation together with the persistence of the changes, supports the opinion that the slight dilatation of the bronchi demonstrated bronchographically constituted real bronchiectasis. It is believed that the moderate cylindrical, advanced cylindrical, and fusiform bronchiectasis, definite and uncontroversial as they are, represent various stages in the progressive development of bronchiectasis from the minimal cylindrical stage. This is comparable to the progression of tuberculosis from the minimal to the advanced stage.

Lobe involved.—These cases follow the well-known pattern of distribution of bronchiectasis, namely, predilection for the lower lobes with the left lower lobe being most frequently involved.

TABLE 9.—*Lobe involved*

Lobe	Cases
Left lower.....	18
Right lower.....	10
Right lower and left lower.....	6
Right lower, middle, and left lower.....	2
Right middle.....	1
Right lower and left upper (lingulus).....	1
Right lower and middle.....	1

Bacteriology.—Sputum studies were done in all these cases, but complete records are not at hand. All were negative for tubercle bacilli. The streptococcus pyogenes (streptococcus hemolyticus) was the organism most commonly found. Hemolytic and nonhemolytic staphylococci and pneumococci also were frequently present. Spirochetes were seldom found.

TABLE 10.—*Concurrent sinusitis*

Evidence for diagnosis	Cases
Clinical only.....	2
X-ray only.....	5
Clinical and x-ray.....	8
Negative.....	18
Not recorded.....	6

Concurrent sinusitis.—Every patient suspected of having bronchiectasis deserves careful clinical and roentgenographic examinations to determine the presence of sinusitis. Active treatment of existing sinusitis is a necessary part of the treatment of bronchiectasis. It is evident that while sinusitis frequently accompanies bronchiectasis, the absence of sinusitis is not to be taken as supporting evidence that bronchiectasis is not present.

Bronchoscopy.—Thirty-five of these patients were bronchoscoped. The usual findings were an inflamed mucosa with excessive secretion especially noticeable in the bronchi draining the involved lobe or lobes. In one patient who developed atelectasis in the course of his pneumonia, obstructing granulations were seen in the bronchus leading to the involved area in the right lower lobe (case 2). Another showed scarring and narrowing of the orifice to the right-middle-lobe bronchus, but this patient's bronchiectasis was in the left lower lobe (case 3). No bronchial tumor or foreign body was present in any of these patients.

Every patient in whom the presence of bronchiectasis is suspected should be bronchoscoped at least once. Foreign bodies, tumors, and other abnormalities should be looked for, and pus if present should be aspirated. Bronchography can often be combined with bronchoscopy. To effect this, a catheter is introduced before removal of the bronchoscope, and left in place while the patient is taken to the x-ray department. There the opaque oil is instilled under fluoroscopic guidance.

Diagnosis.—Eight of these cases were recognized as probable bronchiectasis following the first roentgenogram after admission to the hospital. The majority of the remaining cases were recognized following an acute pulmonary infection. In most of these, persistent roentgenographic abnormalities after the acute illness subsided were the reasons for carrying out further diagnostic study. In others of this group, the clinical course rather than x-ray findings formed the basis for suspecting the presence of bronchiectasis. The persistence of cough, expectoration and râles for weeks after return of the temperature to normal, repeated episodes of fever with or without roentgenographic evidence of extension of pulmonary disease, and obtaining pus on postural drainage, were the usual clinical features that led to the diagnosis. After the suspicion that bronchiectasis might be present was aroused by roentgenographic findings or by the clinical course, the diagnosis was established by bronchography.

Treatment and disposition.—All patients were placed on a hygienic-dietetic regimen as soon as the presence of bronchiectasis was suspected. They carried out postural drainage on awaking in the morning, one-half hour before the noon meal, and at bedtime. An occasional patient carried out drainage every 2 hours.

Oral sulfonamide therapy has proved of value in treating symptomatic flare-ups and associated pneumonitis. It was used with benefit also in several patients who had considerable sputum, even though the temperature was normal. In one sulfonamide-sensitive patient not included in this series, penicillin was given without appreciable benefit.

Diathermy proved of no value in the few cases in which it was used. Sinusitis was treated actively.

Bronchoscopy and bronchography were not done until after several weeks of medical treatment. Repeated bronchoscopic aspiration was required in one patient who had a post-pneumonic atelectasis with bronchiectasis.

All patients were kept on medical treatment until maximal benefit had been obtained from hospitalization. Before discharge from the hospital these patients were ambulatory and in good general physical condition. Most had little sputum and a few had none. Râles remained over the area of involved lung in some cases; in others the chest was clear on auscultation.

Surgery is recognized as curative treatment for select cases, but we did not recommend it for the patients with minimal bronchiectasis who had few or no symptoms. In several of the patients, lobectomy was clearly indicated. The need was carefully explained to the men, and they were informed in detail as to the procedure to follow to obtain this treatment. All were eligible for transfer to a Veterans Administration Facility. For those who chose to be cared for by civilian surgeons near their homes, specific references were given.

Even when surgical treatment was not indicated, the patients were urged to consult a civilian physician promptly after returning home. All were advised to continue postural drainage. A warm, dry climate was recommended for some, and probably would be beneficial to all. The importance of avoiding respiratory infections was emphasized.

When we first began to recognize minimal cylindrical bronchiectasis, there was a question as to the significance of the bronchographic findings. Four men with minimal cylindrical bronchial dilatations were given the diagnosis of bronchitis, chronic. Because of symptoms which precluded duty, one of these was surveyed from the Navy. The other three men were returned to duty. On reviewing the clinical and roentgenographic findings in those three cases in the light of subsequent experience, it is now obvious that the correct diagnosis in all those cases was bronchiectasis. It was an error to return them to duty.

All the other patients were discharged from the Navy on approved medical survey.

Prognosis.—Bronchiectasis is generally considered to be a progressive disease. However, the repeated observation of a minimal cylindrical bronchiectasis in an individual whose disease had its beginning during a severe pulmonary infection 15 or 20 years before, indicates that this progression is at times very slow. Some of the minimal cases first recognized after an acute pulmonary infection showed definite symptomatic and even bronchographic improvement with prolonged medical treatment. We do not know how much further im-

provement is to be expected in those cases, but it seems probable that those of long standing or even of presumably recent origin with definite structural changes, are unlikely ever to return completely to normal. On the other hand, with repeated superimposed infection, progress of the disease can be expected. It seems likely that the cases of moderate and advanced cylindrical and of fusiform bronchiectasis are at times actually later stages in the progression beyond the minimal cylindrical stage. The patients with advanced saccular and cystic changes will often show temporary clinical improvement with medical treatment, but these unfortunates have a definitely shortened life expectancy.

Existing prior to entry status.—In 31 of these cases the bronchiectasis was considered to have existed prior to entry into the naval service (EPTE). In the other 8 cases the disease was considered to have originated in line of duty.

The status (EPTE or line of duty) was at times difficult to determine. The bronchiectasis was considered to have originated in line of duty, only when *all* of the following conditions were fulfilled:

1. No history of previous severe respiratory disease.
2. No history of previous frequent mild respiratory disease.
3. No history of respiratory symptoms prior to the illness which developed after entry into service.
4. Bronchiectasis present only at the site of an acute pulmonary infection which developed after entry into service, as demonstrated by physical signs and x-ray.

Service aggravation.—Aggravation by service was admitted whenever an acute pulmonary infection developed in these patients after their entry into service. This practice was based on the belief that bronchiectasis is probably increased in degree after each superinfection, even though the change may be too slight to be measured. It has been argued, and rightly, that even in civilian life these men with bronchiectasis are unusually susceptible to acute pulmonary infections. To this there is the answer that in the service, crowded conditions in barracks and aboard ship create conditions of exposure to infection which are not likely to be paralleled in civilian life.

CASE REPORTS

Case 1.—This 26-year-old apprentice seaman had 1 month of active duty prior to admission to the sick list with sore throat, cough, headache, vertigo, weakness, and aching in the legs. The diagnosis was catarrhal fever, acute. He had been on the sick list for 3 days with similar symptoms 1 week before this admission. Examination showed altered breath sounds and a few râles in the left side of the chest. He appeared to be chronically ill. The temperature never exceeded 102° F. The chest x-ray showed a resolving pleuro-pneumonia in the

left lower lobe. There were several slight exacerbations of fever, and slight cough with purulent sputum persisted. Bronchoscopy was done and lipiodol bronchography revealed minimal cylindrical bronchiectasis in the left lower lobe medial to the shadows of the bronchopneumonia. Even though this man denied previous serious respiratory disease, or frequent mild attacks of respiratory disease, his bronchiectasis was considered, to have existed prior to entry into service. Aggravation by service was admitted. He was discharged from the Naval Reserve on approved medical survey. He was referred to a civilian bronchoscopic clinic for follow-up observation.

Case 2.—This 22-year-old apprentice seaman had 1 month of active duty prior to admission to the sick list with blood-streaked sputum and cough of 1 week's duration. The diagnosis on admission was pneumonia, broncho. His temperature was 104° F. per rectum, he had productive cough, and there were impaired resonance, râles, and bronchial breathing at the right base posteriorly. The roentgenologist reported "moderate disseminated exudative bronchopneumonia in the right lower lobe." Atelectasis was demonstrated in the region of the right cardiophrenic angle. Bronchoscopy revealed granulations in the bronchus to the involved area, and pus was aspirated. Bronchoscopic aspiration was repeated several times but the atelectasis was not completely relieved. Postural drainage continued to produce pus, and râles were persistent at the right base posteriorly. Four months after admission, lipiodol bronchography demonstrated moderate cylindrical bronchiectasis in the atelectatic portion of the right lower lobe. This man had never had a severe respiratory infection or frequent mild respiratory infections. The bronchiectasis was considered not to have existed prior to enlistment. This man was discharged from the Naval Reserve on approved medical survey, and was referred to a civilian bronchoscopic clinic for continued observation.

Case 3.—This 27-year-old specialist, second class, had had 6 months' active duty prior to admission to the sick list under the tentative diagnosis of pulmonary tuberculosis. He complained of cough, blood-tinged sputum, occasional wheeze, malaise, anorexia, and weight loss. At first there were a few inconstant medium râles at the left base posteriorly. Later râles were heard constantly over this area. The chest x-ray was reported as showing evidence of slight bronchitis in the right lower lobe. Postural drainage produced about 15 cc. of thick pus. Bronchoscopy showed scarring and narrowing of the orifice to the right middle lobe and pus coming from the left lower lobe. Lipiodol bronchography demonstrated moderate cystic bronchiectasis in the left lower lobe. This man had had pneumonia three times and dry pleurisy on the left side once before enlistment, but he had been free of respiratory symptoms during recent years. Cough and expectoration appeared shortly after reporting for duty and these symptoms never disappeared. This man's bronchiectasis was considered to have existed prior to entry into service, but aggravation by service was admitted. He was discharged from the Naval Reserve on approved medical survey. Lobectomy was recommended, and reference was made to a civilian thoracic surgeon.

SUMMARY

1. Analysis and clinical discussion of 39 cases of bronchiectasis is presented.
2. Clinical features of minimal bronchiectasis are discussed.

3. Minimal cylindrical bronchiectasis is regarded as bearing a relationship to advanced bronchiectasis similar to that which minimal tuberculosis bears to advanced tuberculosis.
4. Special considerations relating to the bronchiectatic patient in the Navy are discussed.
5. Several illustrative cases are presented.



THE INSTITUTE OF NAVAL MEDICINE

A new scientific Institute, attached to the Red Navy Medical Service with K. M. Bykov, Member of the Academy, as its chief has been inaugurated in Leningrad. Outstanding specialists are on the staff of this institute, which has the following departments: A department for the study of physiology and hygiene of submarine navigation and diving; departments for the study of aviation medicine, rationalization and sanitation of the work of naval experts, of the pathology of injuries, of antiepidemic work, and medical and chemical defense under the conditions of naval warfare.

The department of physiology and hygiene of submarine navigation is developing standards of the medical and hygienic regimes for submarines during long cruises. New methods for air purification have been suggested, and improved methods for its regeneration. In order to prevent "caisson-sickness" in underwater divers, new special respiration regimes are worked out at the Institute to reduce the time necessary for raising under-water divers from great depths.

The department of aviation medicine is engaged in observations on the changes that are produced in a human organism by the excessive strain caused by aerial flight. New methods for training have been suggested, which should precede high-altitudinal flights. Along with this, the cabin of the aeroplane is being studied from the medical and hygienic points of view.

At the department of pathology of injuries the investigation of the pathophysiology of traumas caused by electric currents, and of their treatments, has been brought to an end. Now the department is engaged in investigating submarine electric traumas, the pathogeny and treatment of frost-bites under nautical conditions, the influence of vibrations upon the physiology of the internal organs (digestion, excretion of urine, blood distribution) and other problems. Observations are carried out both in the laboratories and on board ships. Another subject of particular research covers problems relating to the causes and conditions of high-altitude affections.—MEDICAL CHRONICLE: The Institute of Naval Medicine. The U. S. S. R. Society for Cultural Relations with Foreign Countries, Moscow. No. 3, p. 8, March 1945.

GIARDIASIS: QUESTION OF PATHOGENICITY

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and

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It is with great interest we note that the majority of textbooks and publications, especially in recent years, try to connect giardiasis with a definite set of symptoms.

Rissmann (1) even went so far as to classify the symptoms of giardiasis as being related to the vesico-hepatic, gastrointestinal, and a cachectic syndrome.

Drenckhahn (2) theorizes that *Giardia lamblia* may liberate a toxin which, in cases of jaundice, results in an edema of the papilla of Vater.

Welch (3) reports high leukocytosis in a number of cases and changes in the mucosal pattern of the duodenum.

It was then, indeed, a contrast to see that Blacklock and Southwell in their book on parasitology frankly doubt the pathogenicity of *Giardia*. The majority of writers contribute the syndrome of irritable colon as a resultant of *Giardia* infestation with quite optimistic reports that after treatment with atabrine those symptoms would disappear. Even standard textbooks (4) on gastroenterology suggest that giardiasis might cause an irritable colon with diarrheas and constipation. Unfortunately, this over-all optimistic picture was not borne out by the authors. It is felt by us that the presence of giardiasis is coincidental to other digestive disturbances and that the *Giardia* finds a fertile field on previously irritated gastro-intestinal mucosa and gall bladder.

The authors have found giardiasis frequently on routine examination of stools for ulcers, in jaundice, in hookworm infestations, or co-existing with *E. coli*, *E. nana*, and amebiasis, but most frequently in a syndrome of irritable colon. We have also found that the symptoms of which the patient originally complained persisted even after the giardiasis was eradicated by carbarsone or atabrine, and only after the initial disease was properly treated would the symptoms disappear.

Thus in an irritable colon, high-protein diet, sedation, and vitamin therapy in the form of injections of thiamine hydrochloride and liver would hasten the disappearance of the symptoms; in the cases of jaundice, duodenal drainage, dextrose intravenously with parenamine, and a low-fat high-carbohydrate and protein diet.

It was our policy that any patient with findings of flagellates in routine examination of stools received immediate medication with 4-day treatment of carbarsone, one 0.25-gram tablet four times a day, this to be repeated in case of recurrent findings of giardiasis. We have found in all our cases of giardiasis that medication alone and eradication of the *Giardia* in the stools did not stop the symptoms.

Out of 30 of our patients with *Giardia* infestation, predominant symptoms were nausea, vomiting, fullness, and diarrhea alternated with constipation. Two cases had coexisting hookworm; another, filariasis and malaria; 10 had duodenal ulcer; 4 had *E. nana* and *E. coli* coexisting; 2 had *E. histolytica*; 7 had proctoscopic evidence of irritable colon; 7 had normal proctoscopic findings; and 2 had jaundice.

CONCLUSIONS

1. It is believed by the authors that giardiasis is not pathogenic and does not present any pattern of symptoms.
2. It is found coincidental to other gastrointestinal disturbances.
3. In order to prove that *Giardia lamblia* is truly pathogenic, a perfectly healthy individual must be infested with *Giardia* to reproduce those symptoms. Such an experiment has never been done.
4. Eradication of giardiasis from the intestinal tract is simple. The drugs of choice are atabrine, stovarsol, and carbarsone, which are given 1 tablet four times a day before meals for 4 days.

REFERENCES

1. RISSMANN, E.: Über die Lamblia intestinalis in Generalgouvernement. 38: 532, June 5, 1942.
2. DRENCKHAHN, C. H.: Jaundice associated with *Giardia lamblia* infestation. Illinois M. J. 83: 119-121, February 1943.
3. WELCH, P. B.: Giardiasis with unusual findings. Gastroenterology. 3: 98-102, August 1944.
4. MANSON-BAHR, P. H.: Dysenteric Disorders; The Diagnosis and Treatment of Dysentery, Sprue, Colitis, and Other Diarrheas in General Practice. Appendix by W. J. Muggleton. William Wood & Co., Baltimore, Md., 1939.
5. STRONG, R. P.: Stitt's Diagnosis, Prevention and Treatment of Tropical Diseases. The Blakiston Co., Philadelphia, Pa., 1944.
6. CECIL, R. L.: A Textbook of Medicine. W. B. Saunders Co., Philadelphia, Pa., 1942.
7. BECKMAN, H.: Treatment in General Practice. W. B. Saunders, Philadelphia, Pa., 1942.
8. HARTMAN, H. R., and KYSER, F. A.: Giardiasis and its treatment; clinical study, J. A. M. A. 116: 2835-2839, June 28, 1941.

9. WESELMANN, H.: Über die Bedeutung des Vorkommens von Lamblien im Duodenum und im Gallenwegssystem. Deut. Militärarzt 8: 204-207, April 1943.
10. WELCH, P. B.: Giardiasis with unusual clinical findings. J. Digest. Dis. 10: 52-55, February 1943.
11. DHAR, D. R.: Giardiasis as cause of intestinal trouble. Indian M. Rec. 64: 104-107, April 1944.
12. MUKHERJEA, H. P.: Giardiasis. Indian M. Rec. 63: 280-293, October 1943.
13. MARIS, E. P., and BUSHONG, S.: Diagnosis of Giardia intestinalis infestation by means of intestinal intubation; treatment with atabrine and follow-up studies of 68 cases. Pennsylvania M. J. 45: 724-726, April 1942.



THE NATURE OF THE ANTIBACTERIAL AGENT FROM ANEMONE PULSATILLA

"Extracts of buttercups and *Anemone pulsatilla* exhibit antibacterial action against a wide variety of micro-organisms, including gram-positive, gram-negative, and acid-fast bacteria. The present report deals with the identification of the active principle of *Anemone pulsatilla*."

The authors isolated protoanemonin from the dried and ground plants of *Anemone pulsatilla*, which rapidly polymerizes to anemonin and higher polymers in the pure state. * * * "the antibacterial activity of the protoanemonin from the plants compares well with that of the synthetic products. This furnishes biological evidence that protoanemonin is the substance responsible for the antibacterial activity of *Anemone pulsatilla*."

Notes from the Authors' Discussion.—Protoanemonin possesses particular interest, since it appears to be another member of a group of antibacterial agents which includes crepin, penicillic acid, and clavacin. These substances are characterized by the presence of a 5-membered unsaturated lactone ring and in addition have a highly reactive double bond system. They are further unique in being active against both gram-positive and gram-negative bacteria." * * * Treatment of any of these active lactones with alkali to an extent sufficient to hydrolyze the lactone ring results in loss of antibacterial power."—BAER, H., HOLDEN, M., and SEEGAL, B. C.: Nature of antibacterial agent from *Anemone pulsatilla*. J. Biol. Chem. 162: 65-68, January 1946.

THE SPECIFIC GRAVITY OF HEALTHY MEN

A Report of 835 Cases ¹

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The submarine service is particularly interested in picking men who are in the best of physical condition because of the nature of submarine duty, where men are in confined spaces for prolonged periods. Five hundred and thirty-seven cases of submarine personnel were used for determinations of specific gravities, and 298 cases were added from cases accumulated by Commander W. C. Welham, (MC) U. S. N., giving a total of 835 cases.

The determination of physical fitness cannot be made by any single criterion or simple physical measurement. However, the specific gravity of the human body encompasses the most accurate single factor in arriving at an evaluation of physical fitness.

As a means for obtaining physical fitness, the specific gravity determination presents many physical barriers, and this is not adaptable to easy application. Therefore, a more feasible means for determining physical fitness that can be correlated with specific gravity would be desirable and give a more accurate determination of physical fitness than methods now in use, such as height, weight, and age tables which are applicable to very large groups of individuals.

Such a correlation was pointed out by Behnke, Feen, and Welham (1). They showed that in 99 cases there was a close relation between specific gravity and circumferential difference of the chest and abdomen. Cases were used from Navy personnel.

It was felt that more data would be required to further substantiate the correlation of specific gravity and thoraco-abdominal circumferential difference.

The relationship of specific gravity to the thoraco-abdominal circumferential difference in 835 cases indicates a definite functional trend. As pointed out by Welham and Behnke (2), this relationship

¹ By the kind permission of Commander W. C. Welham (MC) U. S. N., data on 298 cases compiled by him were used.

TABLE 1.—Thoraco-abdominal circumferential differences in inches listed under specific gravities

Specific gravity	Difference in inches		Specific gravity	Difference in inches		Specific gravity	Difference in inches		Specific gravity	Difference in inches		Specific gravity	Difference in inches	
1.010	1.8	-----	1.049	5.1	2.0	1.060	7.0	4.2	1.069	6.9	5.3	1.077	7.2	7.1
1.011	-----	-----		3.9	7.0		5.1	6.7		9.2	6.2		7.2	8.6
1.012	-----	-----		5.6	3.9	1.061	3.3	6.6		6.9	6.4		5.6	4.9
1.013	-----	-----	1.050	0.8	6.1		2.5	6.7	1.070	4.0	8.4		6.6	4.9
1.014	2.7	-----		5.1	4.9		6.7	5.9		6.9	4.5		6.6	6.5
1.015	-----	-----		3.2	5.2		7.0	4.7		8.0	5.7		9.0	4.0
1.016	-----	-----		4.7	3.0		8.3	6.2		6.8	6.0	1.078	5.6	6.2
1.017	.4	1.0		1.0	2.9		6.5	4.5		6.3	7.0		6.0	5.7
	3.4	-----		6.0	4.0		5.4	4.0		6.6	9.7		7.7	8.2
1.018	1.7	-----		4.6	-----		5.7	5.1		8.7	6.0		6.6	8.4
1.019	-----	-----	1.051	2.5	4.7		7.0	-----		6.5	6.1		6.8	7.7
1.020	2.5	-----		7.5	4.7	1.062	8.6	6.9		6.6	6.3		6.5	8.0
1.021	1.6	3.9		5.5	4.1		7.3	5.8		6.3	5.4		5.7	6.2
1.022	3.9	2.7		6.0	7.5		6.8	7.0		6.2	6.0	1.079	8.0	6.9
1.023	1.0	3.4		1.7	7.0		6.2	6.4		6.1	5.9		8.6	6.4
	3.0	-----		4.6	6.0		6.0	7.5		6.6	9.9		7.8	9.2
1.024	-----	-----		4.7	4.5		6.5	6.0		6.0	6.2		6.3	8.4
1.025	-----	-----		7.0	4.4		5.2	6.0		5.0	4.9		7.3	8.6
1.026	-----	-----	1.052	4.5	3.3		5.6	6.6		6.1	9.0		7.2	8.5
1.027	2.4	2.9		3.8	5.0		6.9	5.1		6.3	6.2		7.7	7.5
	2.2	-----		6.9	6.1		4.0	-----	1.071	6.5	7.1		7.6	7.7
1.028	-----	-----		2.2	4.5	1.063	7.6	4.1		8.1	7.7	1.080	8.8	7.9
1.029	2.1	1.8		6.9	6.9		5.5	7.0		7.0	7.9		9.2	8.0
1.030	3.0	4.6		7.0	3.2		3.3	5.7		6.9	4.2		5.4	6.0
	3.0	3.0		5.4	6.0		5.0	4.5		6.4	7.9		5.1	6.7
	2.4	4.9		4.9	-----		4.8	6.2		6.9	7.9		8.0	6.2
	2.0	2.7	1.053	3.5	5.1		8.0	8.3		5.8	6.3		7.6	6.2
1.031	1.0	-----		2.4	2.5		6.1	5.2		8.2	7.2		7.1	4.1
1.032	-----	-----		2.9	6.0		4.2	-----		7.0	8.0		5.8	8.5
1.033	-----	-----		3.3	5.8	1.064	7.3	6.2		8.0	7.4		5.0	6.0
1.034	3.5	2.6		6.0	4.3		5.7	6.2		6.7	6.0		6.1	9.2
1.035	3.8	-----		6.3	5.3		5.0	6.2		8.0	5.9		9.0	8.8
1.036	3.8	3.4		4.7	-----		7.2	6.6		5.1	6.0	1.081	8.8	5.1
	3.3	-----	1.054	6.0	6.3		4.7	6.1		6.7	7.6		5.2	5.4
1.037	2.8	2.6		5.2	5.9		5.7	7.1		8.1	-----		3.5	6.0
1.038	-----	-----		4.5	6.0		7.0	6.2	1.072	7.3	7.5		7.3	6.2
1.039	-----	-----		3.4	5.9		6.1	6.4		7.2	6.9		7.1	5.7
1.040	4.5	1.7		5.4	6.0		6.7	7.7		5.0	8.2		6.3	6.1
	2.1	4.1		1.6	5.9		4.7	-----		5.1	5.6		5.3	6.9
	1.0	4.0	1.055	4.1	5.6	1.065	3.8	6.4		5.1	5.0		5.8	6.4
	2.1	2.7		6.1	6.0		5.9	4.5		5.4	8.0		12.7	7.1
	1.1	2.6		5.8	5.1		8.1	6.1		7.0	7.9		5.7	9.0
1.041	4.2	2.7		5.8	4.9		5.7	8.1		8.1	10.9	1.082	6.9	-----
	1.5	3.0		3.6	4.6		2.9	5.9	1.073	5.2	9.1		5.9	7.0
	2.0	3.6		6.0	5.2		5.9	5.7		8.1	6.7		8.5	4.0
	2.7	2.7		6.0	4.8		6.6	-----		5.2	6.9		6.9	6.2
1.042	5.0	3.9		3.0	-----	1.066	7.3	7.1		6.3	7.2		8.9	8.2
	1.5	4.4	1.056	4.0	6.0		4.0	7.9		7.3	6.6		5.3	8.9
	3.7	6.2		4.7	5.5		3.9	5.9		5.6	5.4		7.1	9.1
	3.0	4.0		3.7	4.0		5.6	4.0		6.9	5.2		6.3	8.4
	1.7	3.0		6.8	6.5		3.7	7.7		6.4	-----		4.3	7.9
	2.6	2.9		5.8	6.9		3.8	6.5	1.074	8.2	7.1		7.2	8.0
1.043	5.1	5.0		5.5	6.2		7.4	4.6		7.5	6.6	1.083	7.2	8.0
	4.3	-----		6.4	6.0		4.3	7.1		9.0	8.1		6.5	8.3
1.044	5.1	2.7		4.7	-----		3.7	-----		7.0	6.9		6.8	8.9
	3.5	4.1	1.057	6.3	5.6	1.067	6.3	5.9		5.5	6.9		9.7	7.7
	3.6	3.0		8.4	7.1		6.9	7.2		7.6	6.7		6.6	6.5
	4.1	3.1		5.2	7.7		6.7	6.2		8.1	6.1		4.7	9.4
	3.9	2.7		6.9	4.7		5.3	4.0		6.9	4.0		7.3	9.4
1.045	5.0	5.3		5.7	5.1		6.6	7.0		6.2	8.1	1.084	7.4	-----
	4.1	5.1	1.058	6.2	6.9		6.2	6.6		6.8	6.4		6.1	6.7
	4.5	5.1		6.9	4.2		5.1	5.4	1.075	5.6	9.0		8.9	8.1
1.046	4.8	4.0		6.3	6.9		6.4	-----		6.1	8.5		5.7	6.2
	4.9	5.6		6.9	5.9	1.068	7.3	7.0		6.1	7.7		6.0	6.2
1.047	4.3	1.7	1.059	4.2	6.1		5.7	6.9		7.0	6.8		7.6	9.4
	3.6	4.4		5.0	5.3		8.6	6.3		7.9	8.4		7.0	4.3
	4.0	2.9		5.4	6.0		6.3	6.7		5.7	8.6		6.1	8.2
	4.9	4.1		4.6	6.2		3.3	6.6		6.0	8.9		7.6	6.8
	2.7	4.0		6.1	-----		3.5	6.9		6.2	6.2		6.0	-----
1.048	4.0	4.7	1.060	6.8	5.3		6.4	8.4	1.076	6.2	8.8	1.085	7.2	9.7
	5.8	5.9		7.0	5.0		7.2	6.6		8.0	9.4		8.0	9.6
	5.1	4.8		5.8	4.4		7.0	6.7		7.4	8.2		7.8	7.0
	4.5	4.5		5.9	5.1		6.0	-----		7.7	7.6		8.7	6.9
	5.8	6.1		6.9	4.9	1.069	6.4	6.4		4.3	6.1		4.3	4.2
	4.0	4.9		7.0	2.1		6.6	6.0		9.5	8.4		8.7	8.8
1.049	3.5	3.9		6.5	6.0		5.5	7.1		6.3	8.6		7.1	9.8
	4.3	6.0		6.8	5.0		5.9	5.3		5.1	8.4		7.5	-----
	6.6	5.0		5.4	5.0		7.1	6.0		7.1	9.5	1.086	6.2	6.2
	4.9	5.1		6.0	6.9		7.3	5.5	1.077	8.9	6.0		6.3	6.3

TABLE 1.—*Thoraco-abdominal circumferential differences in inches listed under specific gravity—Continued*

Specific gravity	Difference in inches		Specific gravity	Difference in inches		Specific gravity	Difference in inches		Specific gravity	Difference in inches		Specific gravity	Difference in inches	
1.086	8.5	8.5	1.088	6.8	7.7	1.090	7.7	7.6	1.093	10.1	8.5	1.099	7.2	-----
	9.0	8.6		5.9	7.8	1.091	6.1	7.7		7.9	9.0	1.100	8.3	7.9
	8.3	9.1		8.0	4.6		7.6	8.6	1.094	7.0	8.7		8.6	-----
	8.5	8.3		7.0	7.9		9.0	8.0		5.1	8.4	1.101	-----	-----
1.087	6.9	8.4		6.5	-----		5.3	5.3		10.0	6.5	1.102	-----	-----
	7.3	8.8	1.089	8.5	8.7		8.0	8.6	1.095	8.4	8.5	1.103	7.7	-----
	9.2	8.6		7.6	8.6		9.6	9.4		7.9	6.4	1.104	-----	-----
	6.8	3.6		5.4	9.1		7.3	8.8		7.2	-----	1.105	-----	-----
	9.8	9.8		7.3	8.8		6.6	8.7	1.096	10.4	5.9	1.106	-----	-----
	2.4	8.7		7.1	7.1		6.0	5.3		8.7	-----	1.107	5.2	-----
	6.2	8.7	1.090	7.2	7.5	1.092	9.1	8.6	1.097	7.4	5.3	1.108	-----	-----
1.088	9.0	8.1		8.5	7.1		4.5	9.2		9.2	6.9	1.109	-----	-----
	6.6	7.3		9.2	7.4		9.0	9.1	1.098	-----	-----	1.110	7.0	-----

TABLE 2.—*Average of thoraco-abdominal circumferential differences in inches listed under specific gravity*

Specific gravity	Average difference	Specific gravity	Average difference	Specific gravity	Average difference	Specific gravity	Average difference
1.010	1.8	1.036	3.5	1.061	5.7	1.086	7.7
1.011	-----	1.037	2.7	1.062	6.1	1.087	7.5
1.012	-----	1.038	-----	1.063	5.6	1.088	7.2
1.013	-----	1.039	-----	1.064	6.3	1.089	7.8
1.014	2.7	1.040	2.6	1.065	5.8	1.090	6.8
1.015	-----	1.041	2.8	1.066	5.5	1.091	7.5
1.016	-----	1.042	3.6	1.067	6.1	1.092	8.4
1.017	1.6	1.043	4.8	1.068	6.5	1.093	8.8
1.018	1.7	1.044	3.7	1.069	6.4	1.094	7.6
1.019	-----	1.045	4.9	1.070	6.5	1.095	7.7
1.020	2.5	1.046	4.8	1.071	7.1	1.096	8.2
1.021	2.8	1.047	3.7	1.072	6.9	1.097	7.2
1.022	3.3	1.048	5.1	1.073	6.6	1.098	-----
1.023	2.4	1.049	4.7	1.074	7.0	1.099	7.2
1.024	-----	1.050	3.9	1.075	7.1	1.100	7.3
1.025	-----	1.051	4.6	1.076	7.6	1.101	-----
1.026	-----	1.052	5.1	1.077	6.6	1.102	-----
1.027	2.5	1.053	4.5	1.078	6.9	1.103	7.7
1.028	-----	1.054	5.1	1.079	7.9	1.104	-----
1.029	1.9	1.055	5.1	1.080	6.9	1.105	-----
1.030	3.4	1.056	5.5	1.081	6.6	1.106	-----
1.031	1.0	1.057	6.3	1.082	7.1	1.107	5.2
1.032	-----	1.058	6.2	1.083	6.7	1.108	-----
1.033	-----	1.059	5.7	1.084	6.9	1.109	-----
1.034	3.0	1.060	5.6	1.085	7.6	1.110	7.0
1.035	3.8						

holds only for comparisons of groups of men, and not for individual cases. The specific gravity of the men was determined by the method used by Behnke, Feen, and Welham (1). The pulmonary residual air was assumed to be 1,450 cc.

Table 1 presents the thoraco-abdominal circumferential differences under specific-gravity headings. Table 2 lists the average of these specific gravities and figure 1 plots the specific gravity against the thoraco-abdominal circumferential difference. The broken lines in the graph represent single determinations, and are therefore not true group values.

SUMMARY

1. Eight hundred and thirty-five cases are grouped to illustrate the functional relationship existing between specific gravity and circumferential difference in thoraco-abdominal measurements.

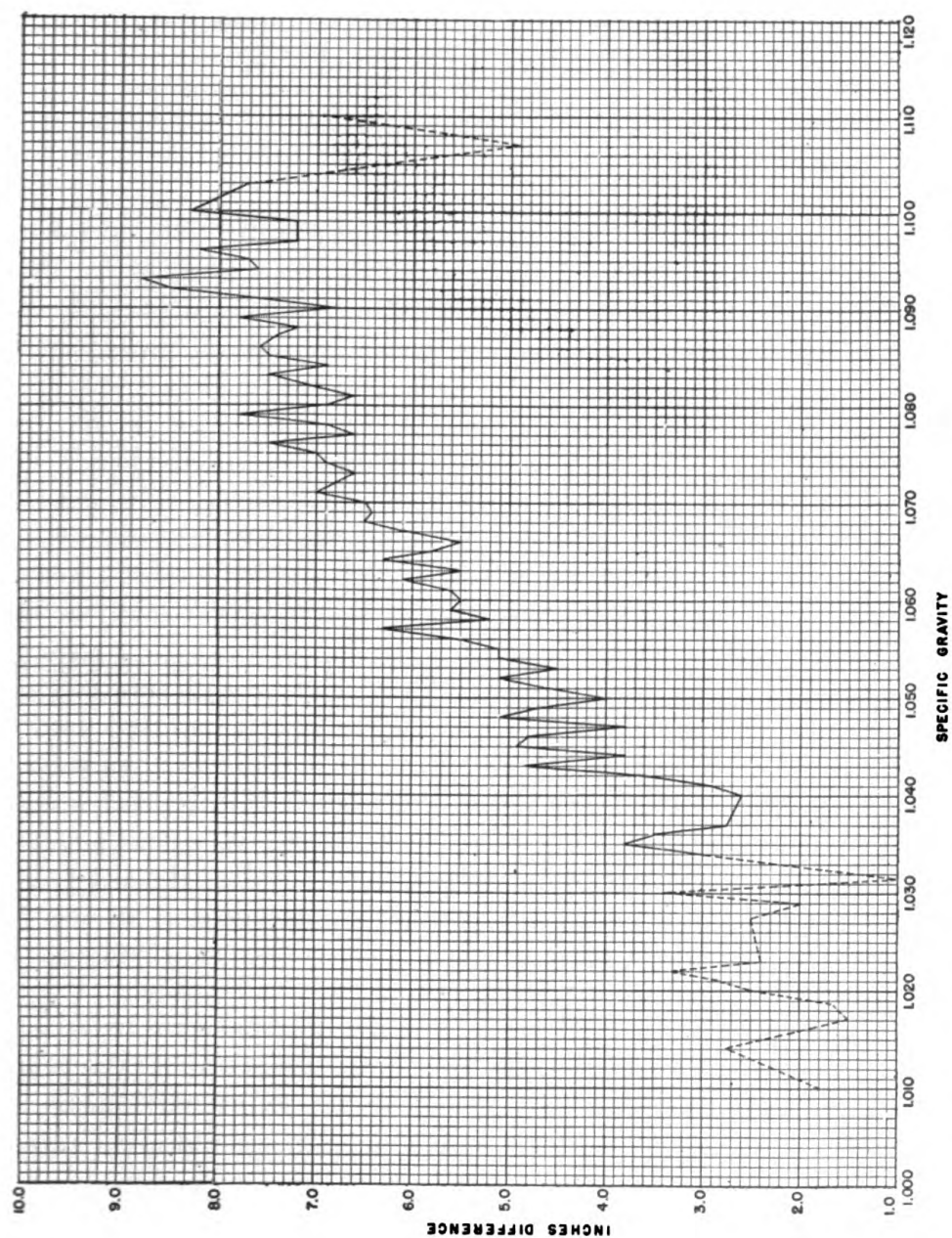
2. These data are not sufficiently inclusive of the low specific gravity group, since the cases were all healthy men already checked over for submarine service.

3. Further work is indicated in the specific gravity zone from 1.010 to 1.040. Thus a more accurate relationship can be made for all specific gravities and thoraco-abdominal differences.

4. The graph showing the functional relationship of specific gravity and thoraco-abdominal circumferential difference may be used as a simple method for selecting men for the specialized duties of deep-sea divers and submarine personnel. A suggested dividing line of a specific gravity of 1.055 may be used as a figure for determining the physical fitness of men for deep-sea diving and submarine duty; this is comparable to a thoraco-abdominal circumferential difference of 5.1 inches.

REFERENCES

1. BEHNKE, A. R. JR., FEEN, B. G., and WELHAM, W. C.: Specific gravity of healthy men. J. A. M. A. 118: 495-498, February 14, 1942.
2. WELHAM, W. C., and BEHNKE, A. R. JR.: Specific gravity of healthy men; body weight÷volume and other physical characteristics of exceptional athletes and of naval personnel. J. A. M. A., 118: 498-501, February 14, 1942.



1. Thoraco-abdominal circumferential differences in inches versus specific gravity.

NEURALGIC REFLEX FROM IMPACTED LOWER THIRD MOLAR

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Physicians and dentists are frequently confronted with atypical pains involving the regions of the oral cavity, face, and head. The predisposing and exciting factors of such pains are very often difficult to determine. However, certain of these cases are due to referred pain from impacted lower third molars.

We may classify complications arising from impacted teeth into two general groups. In the first group we have symptoms produced by tissue changes, such as local inflammatory reactions. The second group is characterized by referred pain, expressed by various types of atypical neuralgia in the region of the oral cavity, face, and head. It is within the latter group that the impacted lower third molar plays a leading role.

The pain associated with impacted third molars and referred to in the areas supplied by the trifacial nerve and associated nerve plexuses of the head and neck is usually constant and of long duration, as contrasted to the intermittent short bouts of pain with ordinary toothaches. The pain may be localized but it is quite often reflected by all branches of the trifacial nerve. Referred pain from the mandibular nerve to maxillary nerve, and vice versa, is an everyday occurrence. We must keep in mind that irritations of any part of the fifth nerve may cause pain in the entire area supplied.

The discomfort may vary from a local sense of pressure to severe or often excruciating pain in widely distributed areas around the head and upper extremities. The two case reports following will illustrate the neuralgic condition which may arise from an impacted lower third molar.

CASE REPORTS

Case 1.—A man, age 21 years, complained of radiating pains around the right eye, temple, across the right cheek and side of nose. Sometimes the pain extended down the back of the neck to the region of third or fourth cervical vertebra. He complained mostly of a sense of pressure around the temple and left cheek.

Two years ago all maxillary molars and bicusps on the right side were extracted to relieve the pain.

A radiogram of the right maxillary region revealed an apparently normal condition. A radiogram of lower right molar region was made and the radiogram showed the lower right third molar impacted in a horizontal position. From this finding it was suggested that pressure was being exerted on the distal root of the second molar and that the roots of the third molar might be crowding the mandibular nerve.

The lower right third molar was carefully extracted, without disturbing the roots of the second molar or the mandibular nerve. At the end of seventh day, neuralgic pain had ceased and within 3 months after date of removal of the third molar the patient was completely free from any symptoms of neuralgic pain.

Case 2.—A woman, age 20 years, complained chiefly of "headache" and "face-ache," not confined to any definite area. Pains had begun 8 months previously and had become gradually worse. Medical studies were negative except for the eyes. Glasses were prescribed and worn but with no relief from the pains. Patient reported for routine dental examination although there were no symptoms referable to teeth at any time. A radiogram was made of the molar teeth. Radiogram of lower right molar region revealed horizontal impaction of third molar with possible cystic condition around the crown. The roots of the third molar apparently were pressing the mandibular nerve to one side.

The lower right third molar was removed, care being exercised not to exert any pressure on the mandibular nerve. On the day after extraction patient declared there were no longer any "headaches" or "face-aches." Eight months later, patient had not been subjected to any neuralgic pains.

Many impacted teeth can be asymptomatic. Cases show, however, that very often many complications arise from them. We should keep in mind that the question of pain due to neuralgic reflexes is a broad one, and at times it is almost impossible to diagnose the basic factor. Most definitely it is a question for close cooperation of the physician and dentist.



EFFECT OF MORPHINE ON RESPIRATION

Intravenous injection of morphine in rabbits under urethane anaesthesia produces similar effects on respiration as sectioning through the caudal third of the pons; there are prolonged periods of apnoea, interrupted by periods of breaths of short duration (Biot's respiration); after double vagotomy, regular slow breathing is restored (1-2 respirations per min.); the expiratory vagal influence is greatly increased; pressure on the thorax increases the rate of respiration, the inspiratory phase of breathing is enhanced, and respiratory movements are seen synchronous with the heart rate.—

BUCHER, K.: Effect of morphine on respiration. *Helvet. physiol. et pharmacol. acta* 2: 5-34, 1944; British Abstracts, AIII—Physiology, Biochemistry, Anatomy, December 1945, p. 840.

PNEUMOCOCCAL VULVITIS AND VAGINITIS

Report of a Case

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In the literature of the past 10 years there is a paucity of material reported by American obstetricians and gynecologists dealing with pneumococcal genital infections. Most of the reports primarily were associated with pneumococcal peritonitis and the authors usually were pediatricians or surgeons.

In 1935 King (1) reported three cases, two with pelvic abscesses from which Type IV pneumococcus was cultured. A third had a tubo-ovarian abscess from which an undetermined type of pneumococci was grown. The first two cases began with leukorrhea, but vaginal cultures were not made. Tompkins (2) could find only 24 cases dealing with pneumococcal pelvic infections in a review of the literature from 1891. He presents three additional cases, a pelvic abscess due to Type I pneumococcus, a tubo-ovarian abscess with Type IV pneumococcus, and a tubo-ovarian abscess from which Type III pneumococcus was isolated. The last two cases began with leukorrhea, but no cultures of the vagina were made.

Bickers (3) in 1938 reported a case of Type II pneumococcus vaginitis occurring in a 9-year-old girl 2 weeks after an upper respiratory infection. The infection cleared up after Type II antiserum was instilled in the vagina. Nuckols and Hertig (4) in an excellent review of the literature dealing with pneumococcal infection of the genital tract reported three additional cases of pneumococcal puerperal infection, all secondary to pulmonary involvement. In their review of 77 cases, the vagina was mentioned only once as harboring the pneumococcus. Fifty-four of the cases occurred following delivery or abortion and 23 cases were not associated with pregnancy and consisted of pyosalpinx, pelvic abscess, or tubo-ovarian abscess. In this series the mortality in diffuse infection was 73.7 percent while in those instances where there was a localized abscess the mortality was 26 percent. However, with the present armamentarium of penicillin, sulfonamides, and antiserum the mortality rate will presumably be much lower.

Poindexter (5) studied 1,975 patients, 399 of whom complained of leukorrhea, and never found pneumococci in cultures of the vagina. On the other hand, Hardy (6) in routine vaginal cultures of 343 children found pneumococci present in one case, and there was no evidence of vaginitis present in that patient. Bennett and Mengert (7) reported 2 cases, the first having peritonitis and pelvic abscess from which Type III pneumococcus was grown. Cultures revealed no pneumococci in the vaginal vault and cervix. The second case had a pelvic abscess followed by peritonitis occurring 7 weeks after delivery and from which Type III pneumococcus was cultured. Bickers (8), in a report of vaginal cultures in 200 consecutive cases whose chief complaint was leukorrhea, found pneumococcus present in four, all children.

Considerable controversy has arisen as to the etiology of pneumococcal genital infection. The usual mode of infection is secondary, i. e., metastatic infection by the blood stream or lymph channels from some active focus elsewhere in the body. The other is a primary infection, i. e., ascending through the genital tract. Nuckols and Hertig believe that the latter mode is possible but not acceptable unless complete studies rule out the existence of a pneumococcal infection elsewhere. On the other hand Tompkins feels that when there is no history of pneumococcal infection elsewhere in the body the infection in the pelvis must be assumed to be primary or ascending in type. Schutt (9) has shown that pneumococci are destroyed by normal acid vaginal discharge. Perhaps that is why it is more common to find pneumococci in the vagina of children, in whom the vaginal discharge is less acid than in women of the childbearing age. However, the vaginal discharge in many women with leukorrhea is alkaline and keeping in mind how often the pneumococcus has been found in the mucous discharges of the respiratory passages, it is remarkable that more cases of pneumococcal vaginitis in the mature woman have not been reported. With the report of this case, the evidence that the pneumococcus can live in the vagina as a primary infection, gives further proof that the etiology of pneumococcal genital infection may be ascending in type.

Pneumococcal vulvitis is probably not so rare as the literature would lead one to believe. The reason for this is that cultures of the vulva and vagina are made too infrequently. In practically every case of vulvitis in the young mature woman, the etiology is due to some offending organism present in the vagina or vaginal orifice. Specific treatment can be instituted and quick results obtained only after the causative agent is isolated. This means that not only a stained smear and hanging drop preparation should be studied, but also aerobic, anerobic, Sabouraud's, and gonococcal cultures prepared. In the case presented

here, for example, the true nature of the disease would have been missed entirely if it had not been the policy of this clinic to do routine cultures in all cases of vaginitis.

CASE REPORT

A 21-year-old, white, married WAVE, seaman first class, nulligravida, with last menstrual period 21 January 1945 reported to the dispensary on 1 February 1945 with chief complaint of itching of the vulva for 2 days. The last menstrual period was associated with severe dysmenorrhea and after the period she had a yellow-brown discharge, constant dull, low backache, and soreness of the lower abdomen. Two days before reporting she began to have severe itching and burning of the vulva. There was slight burning on urination, but no frequency or nocturia. The menstrual flow had lasted the usual 7 days and flow was normal in amount. Her husband had been overseas for 7 months and there was no history of coitus. There was no history of an upper respiratory infection since June 1944.

Past history revealed that tonsils and adenoids had been removed at the age of 8 years. An appendectomy had been performed in 1941. She had never had pneumonia or any serious illness. Review of systems was essentially negative. Menarche began at age 14, occurring every 28 days and lasting 7 days. She had no dysmenorrhea before marriage (January 1941) but did have cramps with every other period until enlisting 10 months ago. Since marriage she has always had a slight, yellow, thick, mucoid discharge and some tenderness in the lower abdomen.

Physical examination revealed temperature 98.7, pulse 78, respiration 18, blood pressure 115/75. Eyes, ears, nose, throat, neck, heart, and lungs were normal. There was slight suprapubic tenderness of the abdomen without spasm. Pelvic examination revealed normal distribution of pubic hair and normal development of labia and clitoris. The labia minora were red and slightly edematous. There was a creamy discharge present between the labia minora and majora. The urethra was red and there was a thick creamy discharge at the vaginal outlet. The outlet was marital and Bartholin and Skene glands were negative. The vagina was snug, with good support, and the mucosa was slightly injected. There was a small amount of creamy material in the crevices of the mucosa. The cervix was nulliparous, firm, smooth, and healthy. The uterus was anterior, usual size, firm and moderately tender. The adnexa were slightly thickened and also tender.

Laboratory studies revealed no trichomonas in the saline smear of the vaginal discharge. Cultures from the vagina revealed no growth on Sabouraud's media, no gonococci, but aerobic cultures revealed a Type III pneumococcus. Sedimentation rate was 9 mm. per hour, RBC 3,230,000, Hgb. 10.2 grams, WBC 6,500. Differential blood smear showed 64 percent neutrophils, 35 percent lymphocytes and 1 percent monocytes. Unfortunately the pH of the vagina was not obtained at this time.

On 1 February 1945 the vagina and vulva were painted with 2 percent gentian violet, as clinically the condition had the appearance of a monilia vulvitis and vaginitis.

On 6 February 1945 there had been no improvement. The report on the cultures had been returned by this time so 100 percent sulfadiazine powder was insufflated into the vagina with an atomizer. She was instructed to take 1 gram of sulfadiazine by mouth 4 times a day, but failed to do so because it nauseated her.

Examination on 10 February 1945 revealed that the discharge and irritation had completely disappeared and the vulva and vagina were practically healed.

A follow-up examination 6 weeks later revealed no recurrence of vaginal discharge or irritation. Examination at that time was completely negative and the pH of the vagina was 4.5. Cultures from the cervix and vagina revealed no pneumococci and the patient was discharged as well.

SUMMARY

1. An unusual case of vulvitis and vaginitis due to Type III pneumococcus occurring in a young woman of childbearing age is reported.

2. This case report gives further evidence that the mode of pelvic pneumococcus infections may be of ascending etiology.

REFERENCES

1. KING, J. E.: Pneumococcus pelvic infection in adults. *Am. J. Obst. & Gynec.* **29**: 341-349, March 1935.
2. TOMPKINS, P.: Pneumococcus pelvic infection in women. *Am. J. Obst. & Gynec.* **31**: 70-78, January 1936.
3. BICKERS, W.: Case of pneumococcus vaginitis treated with antiserum. *Virginia M. Monthly* **65**: 104-105, February 1938.
4. NUCKOLS, H. H., and HERTIG, A. T.: Pneumococcus infection of genital tract in women especially during pregnancy and puerperium. *Am. J. Obst. & Gynec.* **35**: 782-793, May 1938.
5. POINDEXTER, H. A.: Some observations on infectious agents causing leucorrhea during childbearing period. *Am. J. Obst. & Gynec.* **36**: 1052-1055, December 1938.
6. HARDY, G. C.: Vaginal flora in children. *Am. J. Dis. Child*, **62**: 939-954, November 1941.
7. BENNETT, A. W., and MENGERT, W. F.: Pneumococcus, type III, associated with pelvic inflammatory disease. *Am. J. Obst. & Gynec.* **39**: 142-144, January 1940.
8. BICKERS, W.: Leukorrhea; new classification and new approach to treatment. *Virginia M. Monthly* **70**: 135-140, March 1943.
9. SCHUTT, A.: Der Pneumokokkus als regier von Wundensektionen, insbesondere der Sepsis puerperulis. *Zentralbl. f. Bakt.* **131**: 155, 1934.



EFFECT OF TESTOSTERONE ON TISSUES

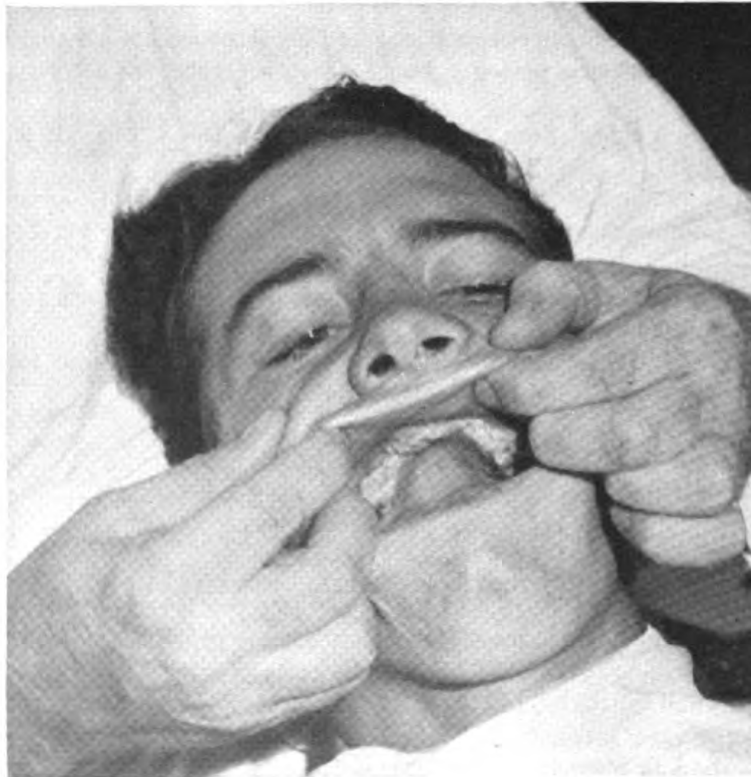
Capons and female fowls given testosterone propionate developed skin and muscle tissue that had significantly greater tensile strength than normal untreated fowls. The tissues of treated birds contained more collagen nitrogen and a larger number of connective tissue fibers than in normal birds.—HERRICK, E. H.: Tensile Strength of Tissues As Influenced by Male Sex Hormone. *Anat. Rec.* **93**: 145-149, October 1945.

PROSTHETIC RESTORATION FOLLOWING GUNSHOT INJURY OF MAXILLA

HARRY E. DENEN

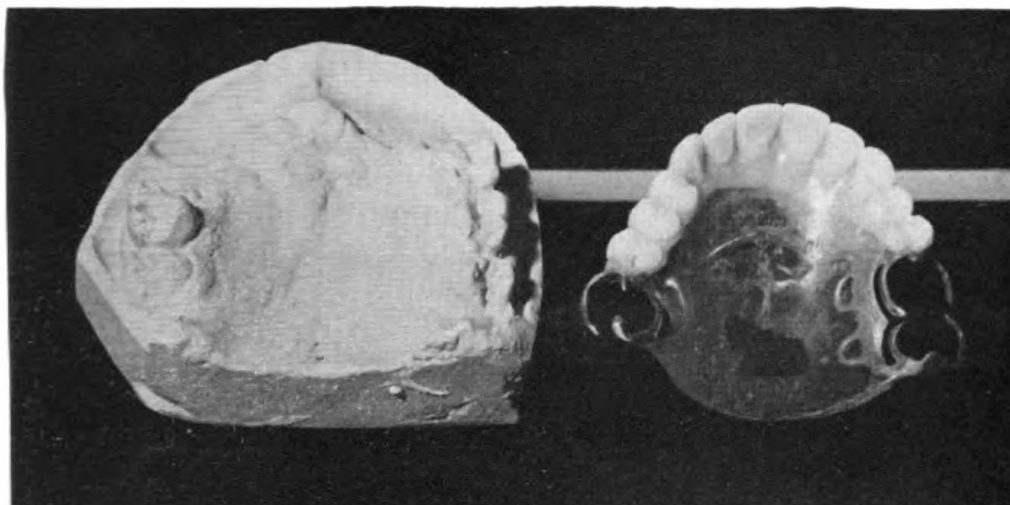
Lieutenant Commander (DC) U. S. N. R.

Under normal conditions, dental prosthesis presents many and varied problems relative to obtaining a successful end result. Gunshot wounds of the face present a formidable task for both the prosthodontist and the surgeon, inasmuch as the areas involved are generally of such great importance, both from an esthetic and functional standpoint, that the least amount of surgery performed in the initial stages will be most beneficial. By a like token, unnecessary and sometimes spectacular surgery may preclude the possibility of constructing a successful prosthetic appliance.



—Official U. S. Navy Photo.

1. Condition of the mouth without the appliance.



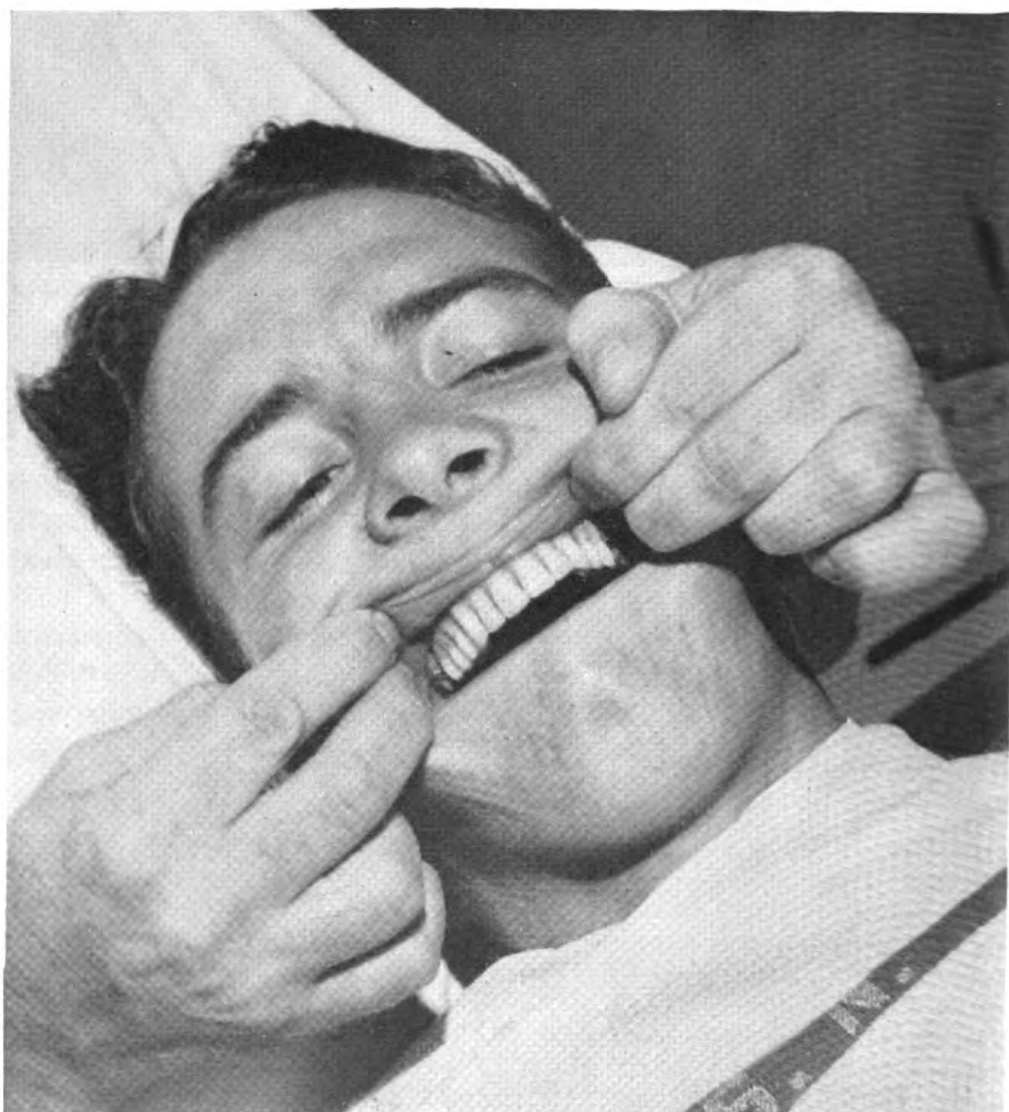
—Official U. S. Navy Photo.

2. Model of the jaw showing terrific bone loss and completed prosthetic appliance.

It is quite obvious that on the field of battle only a limited amount of aid can be rendered at the time, but when the patient is evacuated to a hospital much care and discretion must be used to preserve as much of the remaining bony foundation, particularly in injuries to the maxillary bones. Consideration for the safety and well-being of the patient should, of course, always be of primary importance.

Next in thought then should be the prosthetic future for the patient. Although plastic surgery may be utilized in many cases, nevertheless where there is gross loss of skeletal foundation, this procedure may not be too successful and a prosthetic restoration may be a very trying and futile effort both for patient and dentist.

Case report.—A Marine corporal, age 20 years, received a gunshot wound of the face on the twenty-eighth day of battle at Iwo Jima. A 31 or 32 caliber bullet entered the right cheek and tore away the anterior portion of the maxilla with all teeth from the right second molar to left first molar. The bullet perforated both maxillary sinuses and the floor of the nose, exiting through the left cheek just below the malar bone. Patient was given first aid at a field hospital and evacuated to a naval hospital in the United States. He was treated at the eye, ear, nose and throat department where necessary plastic closures were made of both antra and the covering over the floor of the nose. Because of the shattering effect of the bullet, small bony sequestra appeared for several weeks, but otherwise healing was comparatively uneventful. The labial frenum was left intact, but presented a prosthetic problem because it had been drawn posteriorly when the mucous membrane was reattached to the healthy periosteum. The reason this is mentioned is that at present there is a ptosis of the left upper lip due to injury of the facial nerve and there is a partial paralysis of that area. It was feared that because of this the bulk of material necessary to fill in the loss



—Official U. S. Navy Photo.

3. Prosthetic appliance inserted.

of the labial vestibule would hamper the normal performance of the lip. The teeth remaining, numbers 1, 2, 14, 15, 16, were not the ideal for partial denture retention, so every thought of design was made with the idea of relieving these teeth of most of the burden of carrying the masticatory load and delegating this to most of the remaining tissues by covering all the palatal portion of the maxilla and utilizing the teeth merely as stabilizing agents. A gold skeleton was cast to embody all these principles and the details of esthetics and occlusion were carried out in acrylic resin. Results were most gratifying to both doctor and patient. Accompanying photographs were taken a week after appliance was inserted. At the present writing there has been no discomfort in the area of the labial frenum and under the circumstances, patient seems to be manipulating his upper lip without any difficulty.



—Official U. S. Navy Photo.

4. Completed case. Paralysis of upper left side of lip and cheek, caused by injury to facial nerve, causes the slight droop of the lip.



DEEP LYMPHATICS OF THE SPLEEN

"Contrary to the most recent statements on the subject, deep lymphatic plexuses piercing the white pulp (lymphoid sheathes) are present in the spleens of the guinea pig, mole, mouse, horse, and monkey. In the guinea pig, mole, and mouse they follow the course of the white pulp arteries and open into lymphatic vessels at the hilus. In the horse, they can be traced into trabecular and capsular lymphatic plexuses. These channels contain large numbers of lymphocytes which should be considered in any analysis of the leukocyte producing potencies of the spleen. Comparisons of arterial and venous bloods alone would not give a true picture of splenic hemopoiesis in the animals listed."—SNOOK, T.: Deep lymphatics of the Spleen. *Anat. Rec.* 94: 43-51, January 1946.

A SUGGESTED MODIFICATION OF THE BOGEN PROCEDURE FOR DETERMINATION OF ALCOHOL IN BODY FLUIDS

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The procedure introduced by Bogen (1) (2) (3) for the determination of alcohol in body fluids has been extensively used with very satisfactory results (4) (5). Alcohol in blood or other body fluids is volatilized by heat and transferred into Anstie's reagent by means of a negative or positive pressure. The potassium dichromate in the Anstie's reagent is reduced by the alcohol and this quantitative reduction is determined by visual comparison with standards.

Inasmuch as the alcoholic concentration of blood or urine frequently serves as confirmatory evidence of intoxication, the laboratory officer should be capable of proving that no interfering substance could have been introduced in the specimen after it was obtained and during the process of analysis. Although it is well recognized that alcohol is not a common contaminant of air in most laboratories where this test is performed, it is, however, advisable to prove that no volatile reducing substance was present in the air used in the process of aeration. It is unnecessary to state that all glassware should be free of any reducing material.

SUGGESTED MODIFICATION

It is recommended that another tube containing Anstie's reagent should be added to the aeration system (fig. 1). The air used in the aeration system should be forced through this tube of Anstie's reagent before entering the tube containing the fluid to be tested. Any traces of alcohol or any other interfering substance will be removed by this reagent. The Anstie's reagent will act as an indicator as well as a chemical filter. The fifth tube, which also is the last tube of the system and the test tube to which the reduced Anstie's reagent is transferred for comparison with the standards, can be proven to be free of all reducing substances by heating Anstie's reagent in these two tubes prior to their use in the test. It is advisable to perform a blank deter-

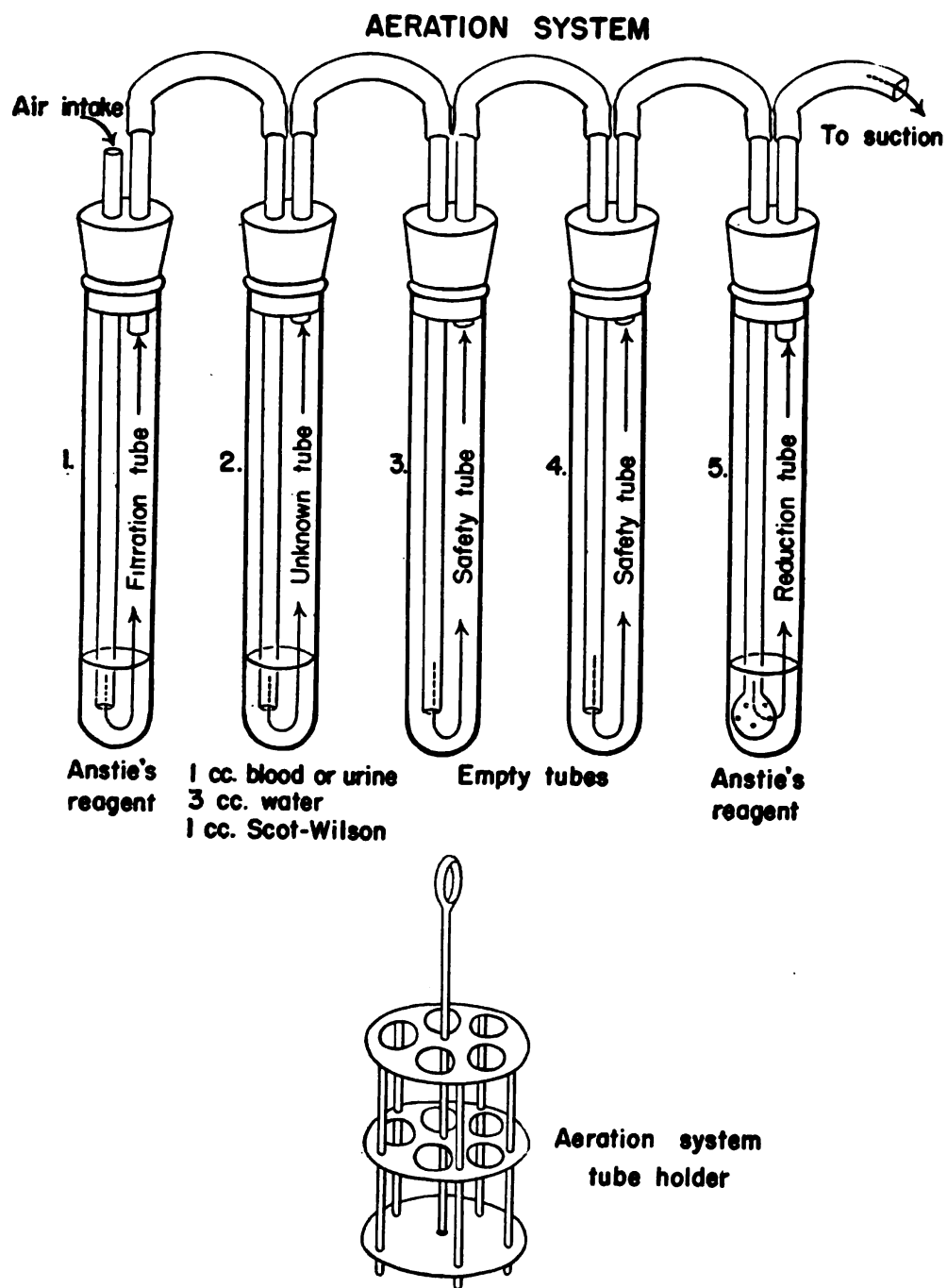


FIGURE 1.

mination on all of the reagents including the distilled water. The distilled water which is required for the test may be stored in a tight glass-stoppered bottle. If these reagents are properly stored and frequently used, it should not be necessary to check them before each determination.

RESULTS

The air entering the aeration system was forced through a 0.2-percent aqueous solution of ethyl alcohol to determine the efficiency of Anstie's reagent in removing alcohol from the air. In every instance, the potassium dichromate in the reagent in the first tube showed some reduction; and no reduction occurred in the fifth tube. When air was forced through a 1-percent alcohol solution the Anstie's reagent was capable of removing all the alcohol for approximately 2 minutes of the aeration time. After the complete reduction of the reagent in the first tube the alcohol passed through the aeration system and entered the last tube where it was demonstrated by the color change.

ACCURACY OF THE PROCEDURE

An attempt was made to determine the accuracy of the procedure by adding various known quantities of ethyl alcohol to blood specimens. These specimens were obtained from individuals who stated that they had not had any "so-called" alcoholic beverage for at least 48 hours prior to the veni-puncture. The specimens were tested before and after the addition of alcohol. An approximately constant negative pressure, which was determined with a manometer, was used in the aeration for all determinations. The results obtained are recorded in table 1.

Various quantities of anesthetic-diethyl ether were added to aliquots of some of these specimens. After the addition of ether the specimens were shaken and tested with the previously described procedure. These results are recorded in table 2.

Blood specimens were obtained from three patients who were anesthetized with ether. These specimens were transferred from the syringes into screw-cap vials. The contents of the vials were shaken before the bottles were opened. A strong odor of ether was present when the bottles were opened for analysis. The total quantity of volatile reducing substance found in these specimens by this procedure was 0.5, 0.25, and 0.25 mg. per cc.

DISCUSSION

If the air used for aeration in the suggested procedure is previously forced through Anstie's reagent any traces of alcohol or any other

volatile reducing substance present in the air will be removed. Furthermore this reagent will act as an indicator as well as a filter. If there is no change of color of the reagent, no interfering substance was present in the air.

Blood from individuals who had not consumed any "so-called" alcoholic beverage contained from zero to 0.50 mg. per cc. of volatile reducing substance. When alcohol was added to blood specimens the total quantity of volatile reducing substance recovered was never in excess of the quantity of alcohol added, plus the quantity of volatile reducing substance originally present in the blood.

When ether was added to blood only a very slight increase in volatile reducing substance was found in 2 of 8 determinations. Furthermore, blood specimens obtained from three patients who were anesthetized with ether, did not show a concentration of volatile reducing substance above the normal value. Ether is a volatile reducing substance that will reduce Anstie's reagent if the rate of aeration is *very slow*. However, ether apparently will not interfere with this procedure if the rate of aeration is satisfactory.

TABLE 1.—Volatile reducing substance recovered (after addition of alcohol to blood)

Volatile reducing substance in blood	Quantity of alcohol added to blood	Total volatile reducing substance recovered	Volatile reducing substance in blood	Quantity of alcohol added to blood	Total volatile reducing substance recovered
Mg./cc. ¹	Mg./cc.	Mg./cc.	Mg./cc.	Mg./cc.	Mg./cc.
0.25	1.0	1.25	(?)	2.0	2.00
.25	1.0	1.25	.50	2.5	2.75
.25	2.0	2.25	.25	2.5	2.50
.25	2.0	2.00	(?)	2.5	2.50
(?)	2.0	2.00	.25	3.0	3.25
.25	2.0	2.00	.25	3.0	3.00
.25	2.0	2.25	.25	3.0	3.00

¹ A set of 17 standards was used for these determinations, varying by 0.25 mg. of alcohol per cc.; from the first containing no alcohol to the last containing 4 mg./cc.

(?) Negative.

TABLE 2.—Volatile reducing substance recovered (after addition of ether to blood)

Volatile reducing substance in blood	Quantity of ether added to blood	Total volatile reducing substance recovered	Volatile reducing substance in blood	Quantity of ether added to blood	Total volatile reducing substance recovered
Mg./cc.	Mg./cc.	Mg./cc.	Mg./cc.	Mg./cc.	Mg./cc.
0.25	1.0	0.25	0.25	2.0	0.50
(?)	2.0	(?)	.25	2.0	.25
(?)	2.0	(?)	.25	2.0	.25
.50	2.0	.75	.25	3.0	.50

(?) Negative.

REFERENCES

1. BOGEN, E.: Diagnosis of drunkenness; quantitative study of acute alcoholic intoxication, California & West. Med. **26**: 778-783, June 1927.
2. BOGEN, E.: Drunkenness; quantitative study of acute alcoholic intoxication. J. A. M. A. **89**: 1508-1511, October 29, 1927.
3. BOGEN, E.: Drunkenness; quantitative study of acute alcoholic intoxication. Amer. J. M. Sc. **176**: 153-167, August 1928.
4. HALL, W. W.: Drunkenness, naval medico-legal aspects of diagnosis. U. S. Nav. M. Bull. **34**: 149-163, April 1936.
5. Manual of Clinical Chemistry (Part 1). Naval Medical School, National Naval Medical Center, Bethesda, Md.



TREATMENT OF LEPROSY

The French Ministry of Information has announced the discovery by Drs. Grimès and Pierre Boiteau of a new remedy for leprosy. The drug is a glucoside extracted from *Hydrocotylus asiatica*, an umbelliferous plant growing on Madagascar. The glucoside was named "asiaticoside" by Boutemps. It proved to be far less toxic than the previously isolated substances and as active. Asiaticoside is insoluble in water, and very soluble in alcohol, but dissolves easily in pyridine. Boiteau has prepared a solution which can be used by injection and the results of its use are described as being remarkable. Ocular affections are cured at once, provided the posterior chamber is not affected. Diffuse infiltrations disappear. Lepromata break down and fill with fluid and rupture, and finally cicatrize. Acute lesions of the digits and perforating ulcers heal. The nervous types of leprosy and muscular lesions improve slowly, as does anesthesia, but a number of patients under treatment in Madagascar improved so much that a recovery appears possible.

Boiteau and Grimès consider that asiaticoside probably dissolves the waxy capsule of Hansen's bacillus, and thus renders it vulnerable either to the defensive agents of the host or to other drugs.

Should the researches now in progress be extended one wonders whether the new remedy might not prove of service in tuberculosis, for Koch's organism has a similar protective waxy envelope.—J. H. S.: New method of treating leprosy. The East African Medical Journal, **22**: 243, July 1945.

SOME PROBLEMS ENCOUNTERED IN DENTAL PROSTHETICS FOR RECRUITS

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The rehabilitation of badly broken-down dentition in the limited time available during recruit training is a task that calls for the maximum in effort, skill, and facility of the Dental Corps of the Navy.

The problem of constructing adequate prosthetic restorations for these dental cripples is not the least of the many problems confronting the dental officer in the Navy.

Many of the men entering recruit training display the results of mouth neglect in all forms. Large edentulous areas are seen with third molars still unerupted or in process of eruption. Bites have closed to the extent that upper and lower tissue is in contact in the third molar area. In many cases, the lack of replacements has caused the extrusion of opposing teeth. Lower anterior teeth in centric occlusion are often found in contact with tissue behind missing upper anteriors. All forms of malocclusion are found complicated by the absence of teeth. Teeth necessary for clasping are seen with insufficient crown surface exposed to properly fit a clasp.

No time is lost after the start of recruit training, in removing all diseased and broken-down teeth. Questionable teeth are removed but every effort is made to retain and restore anatomy of any teeth that will assist in the stabilization of the denture. The alveolar process is trimmed and smoothed at the time of extraction and every assistance given to nature's early healing and repair.

The recruit presents himself for prosthetic treatment during the latter phase of his training. Where surgery has been undertaken, the tissues are then in a receptive state for prosthesis.

The ratio of partial to full dentures constructed, varies from 2:1 to 4:1 depending on the ages of the recruits in training. The younger recruit for the most part requires partial dentures.

The majority of the full dentures constructed are uppers. With proper reduction of the undercuts and conservative alveolectomy, these cases present little difficulty. However the problem of the unerupted third molar in young recruits is one that requires careful consideration.

It is often wiser to construct the full upper denture over the unerupted third molar than to risk the destruction of much necessary alveolar process. The position of the tooth as disclosed by radiographs and the amount of overlying bone are the deciding factors. After insertion of the upper denture in these cases, the patient is instructed to report any subsequent symptoms of eruption to the dental officer. Careful extraction at a later date will preserve alveolar bone much needed for retention of the denture.

Distal extension cases present a similar problem when the third molar is still unerupted. Here again radiographs decide its retention or removal. The partial denture, properly extended, should not cover the tissue over the unerupted tooth. These third molars if properly cared for after eruption, will many times prevent closure of the bite. Subsequent placement of a clasp or rest on these teeth may serve to further stabilize the denture.

The absence of sufficient interalveolar space for the required posterior extension of the denture base is a condition frequently encountered. Conservative removal of maxillary tissue in this area will provide the desired clearance. It is the duty of the prosthetic surgeon at the time of removal of the posterior teeth to provide this necessary interalveolar space.

In these limited spaces, acrylic teeth are the teeth of choice. The absence of retentive undercuts, combined with the ease of grinding both in setting up and adjusting occlusion, has demonstrated that they are here to stay. Their use in narrow spaces, both anterior and posterior, is a great factor in elimination of the breakage problem.

Extruded teeth in contact with opposing tissue in centric occlusion, present a mechanical problem. Space must be secured and grinding the cusps of the extruded teeth is indicated before impression taking. Where lower anteriors are in contact with palatal tissue behind missing upper anteriors, clearance is obtained by careful reduction and beveling of the incisal surfaces. When sufficient clearance for the necessary thickness of acrylic cannot be safely obtained by reduction of incisal surfaces, a cast metal base with attachments for retention of acrylic teeth and material will provide necessary strength.

Here again, during the stage of mouth preparation, we must temper our conservative tendencies with a little prosthetic horse sense. Retention of an otherwise healthy extruded tooth, particularly when not needed for clasping or stabilization, may destroy the function of an otherwise useful denture. It is often better to be ruthless in condemning these extruded teeth than chance failure in providing comfort and function to the patient.

Every effort must be made to restore normal vertical relation. It is outside the scope of military dentistry however to resort to time-consuming bite-raising techniques familiar to us in civil life.

The time elapsed between surgical preparation and prosthetic treatment precludes loss of dimension during the edentulous stage. Patients for whom new dentures are to replace old and poorly fitting ones are given good comfortable occlusion by the restoration of proper vertical dimension. This applies mostly to full upper and lower, and full upper and partial lower cases.

Cases of malocclusion or nonocclusion complicated by loss of teeth are corrected by the construction of lower acrylic splints. These are constructed as ordinary partial dentures bringing the lower arch into proper function by the restoration of missing teeth and by building up the occlusion in acrylic over the nonoccluding teeth.

In making partial dentures for young recruits the teeth to be clasped often have insufficient crown surface above the gum to properly fit clasps. This condition is commonly found on lower bicuspid, cuspids, and upper second molars. The gingival line in these young patients has not as yet assumed its permanent position.

In cast metal cases the problem is simplified by waxing the clasp arms close to the gingiva on the investment model. In the construction of wrought-wire clasps, however, the technician requires more room in which to properly bend and adapt the arms of the clasps.

At the time the bite is taken and casts examined and surveyed, the cast is cut away at the gingiva of the tooth to be clasped. With a sharp carving tool, enough stone is cut away to simulate the natural contour of the tooth. This gives the needed space to properly place the clasp arms on the desired survey line. Care must be used not to cut the already exposed portion of the crown.

The arms of the clasp on the finished case may slightly displace the free gingiva. This tissue is highly adaptable and in a very short time the gingival line assumes a new position. Good retention is obtained in an otherwise loose-fitting denture.

Some of the problems more frequently encountered in recruit prosthesis have herein been described. There is, however, no one set of answers that solves all our troubles. In the final analysis the success or failure of prosthetic treatment depends on the ingenuity, skill, and judgment of the operator, his knowledge of biology and mouth anatomy, and an understanding of the fundamental principles of balanced occlusion.

EXTERNAL OTITIS IN THE TROPICS

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The therapy of external otitis aboard ships operating in tropical areas constitutes one of the major problems of daily sick call confronting the medical officer because of the number of cases seen and the persistence of this type of infection.

For the most part, this ship had been operating in tropical areas for 16 months, during which time the outside temperature had rarely been below 85° F. and the water temperature 85° F. or more. During the month of January 1945, we saw 15 new patients with external otitis who made a total of 90 sick call visits. The incidence is, therefore, 1 percent of the complement for January 1945 and was similar throughout 1944.

CLINICAL FINDINGS

The cases of external otitis seen may be divided into three difficultly separable groups. This arbitrary grouping may serve as a therapeutic as well as a clinical classification.

Group 1.—This type is seen most frequently. The main complaints are pain in the ear, either constant or upon motion of the ear, discharge, partial deafness, and itching or burning. Manipulation of the pinna is painful and the canal is partly or completely filled with cheesy, white or gray, flaky, moist exudate and cellular debris with, occasionally, considerable purulent material.

The canal is characteristically described as "wet," and removal of the debris and exudate leaves a raw, red, and, sometimes, bleeding surface. There is slight edema of the canal. Frequently the cellular debris covers most of the drum membrane and it is difficult to appraise accurately the condition of this structure until the debris is removed.

Group 2.—Here the dominant complaint is pain of a constant aching severe type with such accessory complaints as swelling of the periauricular tissues, partial deafness, headache, and generalized aching. These men usually have an extremely tender ear which permits only the gentlest manipulation in examination or therapy. The edema of the canal walls is extreme and may displace the pinna laterally to an

easily noticeable degree. It may be such that speculum examination of the entire canal is difficult if not impossible. There is very little exudate in most cases, although this varies greatly, and when it is present removal does not leave a raw, weeping, or bleeding surface. The canal may be either "wet" or "dry," but is usually the latter, and the walls may show scattered tiny pustules. The body temperature varies from 100° to 103° F. and there are the usual associated toxic symptoms.

Group 3.—This smallest of the groups is characterized mainly by itching and occasional slight pain. Examination shows the canal walls to be dry and scaling, with flakes of debris projecting into the canal. Most of this scaling may be removed with a swab, but if carelessly done there will be raw areas left. This condition exists only occasionally as a primary complaint at sick call, but is frequently seen as an aftermath of Groups 1 and 2 cases who have not persisted in reporting for treatment.

PREDISPOSING FACTORS

No attempt was made to assign specific etiological organisms because in the absence of suitable laboratory facilities we were unable to make dependable observations. In view of the successful therapeutic use of sulfonamide preparations, as well as fungicidal agents, we feel that the streptococci and the staphylococci are at least as frequently the causative organisms as are the fungi, and that in some cases both bacteria and fungi are present. Considered here are a number of factors that were contributory to original infections and to recurrences. In each instance we observed cases in which these factors were demonstrated convincingly as precipitating agents.

Climatic conditions.—The excessive heat and high relative humidity constantly present in tropical latitudes is the most important factor. It is not experienced in the United States, while all the others mentioned are seen there frequently. It is the combination of the climatic conditions and one or more of the following-named causes which accounts for the greater incidence of this disease out here. Three 1- to 3-week periods of the 16-months this report covers were spent in the north temperate zone during the winter season. Even though outside temperatures were never very low, during each of these periods cases of external otitis under treatment cleared up very promptly with minimal care, and no new cases or recurrences were seen. These tropical climatic conditions lead to a high content of water of the air in the external ear canals and arrest exchange of water between the skin and air. As a result, the surface cells swell and flake or separate, partly exposing avenues of entrance to bacteria and fungi constantly present.

Entrance of water while under shower.—Many men make a practice of holding the ears open under the shower with the idea of washing out the ear canals. Evaporation from the canal walls is insufficient to remove this water. There were 2 or 3 recurrences among men who did this. The recurrences promptly ceased when the practice was stopped. It is recommended that all men serving in the Tropics use care in excluding water from the ears while taking a shower.

Entrance of salt water while swimming.—Entrance of salt water into the ear canals while swimming has long been considered a major factor in bringing about infections here. The laymen think that there is a "germ" in the water which does the harm, but this, of course, has never been proved. The salt water causes marked swelling and fissuring of the tissues lining the canal and greatly predisposes to onset or exacerbation of infection. An air group commander was seen who had been treated unsuccessfully for 9 months. Within 2 weeks after he stopped swimming his ears were clean and well and there was no recurrence.

Removal of wax with toothpicks, etc.—Removal of hard plugs of wax by lavage at times reveals boggy, raw, and weeping canal walls, and inquiry will elicit the information that the individual had made one or more attempts to remove the wax and in so doing had traumatized the skin and brought about the infection. The itching so prominent in Group 3 leads to digging in the ears with toothpicks, matches, pencils, paper clips, safety pins, and wire loops, and the result is a transformation to Group 1 or 2.

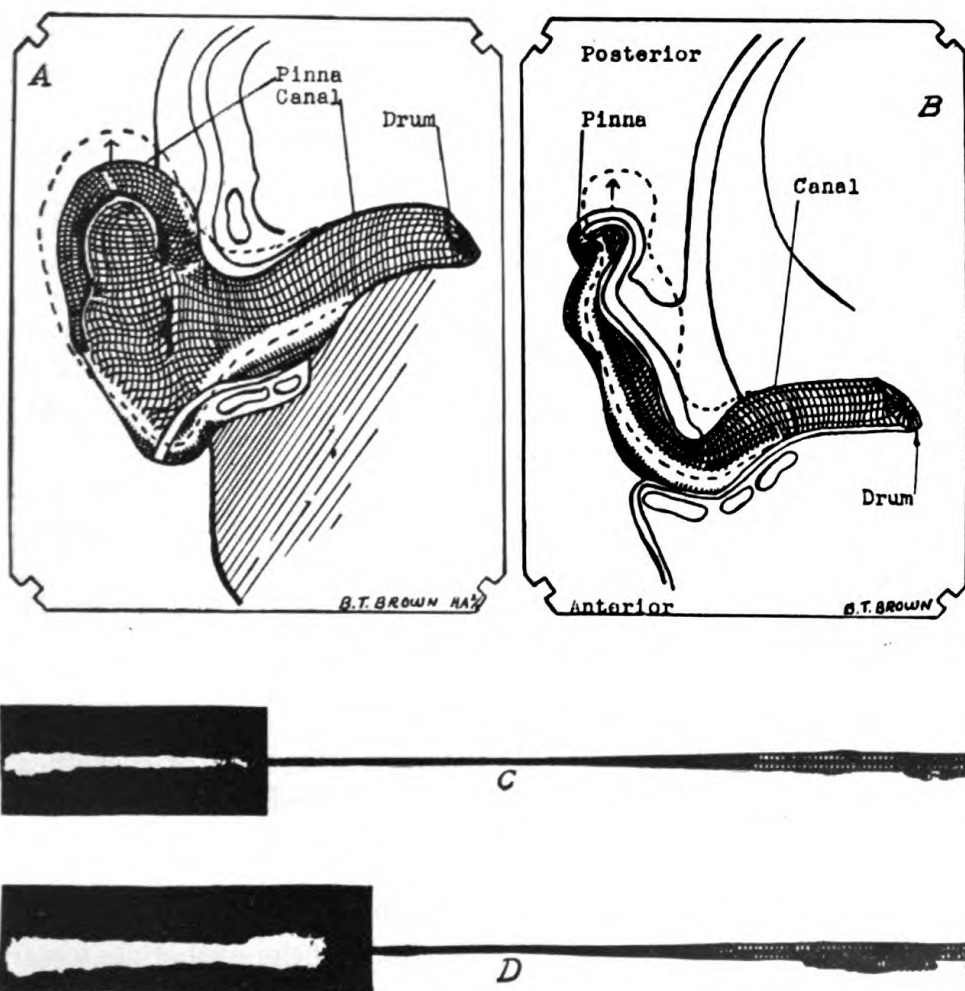
"Dry" wax and "eczema".—Production of "dry" wax, or no wax or oil at all, in the ear canal leads to scaling and fissuring of the skin, giving the picture commonly known as "eczema" of the external ear canal. Fully developed this "eczema" is identical with the picture seen in Group 3 and may quickly develop into either of the other two types.

TREATMENT

The ideal treatment for all types of external otitis is x-ray therapy, but unfortunately no facilities for this are available aboard ship. In the absence of a suitable x-ray machine it cannot be overemphasized that no one therapeutic agent is universally efficacious.

Group 1.—Thorough cleansing of the ear is absolutely necessary before any treatment is given. Actually the meticulous attention to this cleansing process is almost as important as the therapeutic agent used, and this principle applies in the treatment of all three groups. Cleansing is done with a metal applicator having a small amount of cotton turned about the end and dipped in 4-percent solution of boric acid in 50-percent ethyl alcohol. The cotton tip *must* be small enough to pass

into the canal without touching the walls so that the debris and exudate may be wiped *out*. Care must be taken not to push the debris farther into the canal. When the applicator is inserted the pinna should be pulled up and back to straighten the canal. The diagrams show the mechanism of this. Note also the picture of the applicator as it appears when prepared for cleaning and for insertion of the wick. The four walls of the canal are wiped outward, using a new cotton tip if necessary for each wall, and one or more tips are used to dry the walls. Speculum inspection is then done to be sure that all debris



(A) Right ear. Coronal section.

(B) Right ear. Horizontal section.

Dotted lines show position of canal walls when traction is exerted backward and upward on the pinna.

(C) Metal applicator prepared for cleansing the ear.

(D) Metal applicator prepared for inserting a cotton wick in the ear.

is removed and the canal walls left dry and clean. If the amount of debris is large and some is close to the drums it may be necessary (and frequently is) to lavage the canal with warm water. After this is done the boric acid-ethyl alcohol mixture is used and the canal walls dried thoroughly.

A cotton wick, which has been prepared by winding cotton loosely about a metal applicator until it is about 2 inches long and large enough around to fill the canal snugly, and soaked in 10-percent aqueous solution of sodium sulfadiazine, is inserted into the canal after this cleansing process is satisfactorily completed. If the cotton is loosened on the applicator tip after dipping into the solution it may be slipped off easily after insertion into the canal. The wick must extend almost to the drum and the projecting portion may be tucked into the outer part of the canal. During the first 2 days the wick must be changed three times each day, cleansing the ear thoroughly each time.

Hospital corpsmen may be trained to do the cleansing and inserting of the wicks but they must be carefully instructed and checked on frequently.

On the morning of the third day the canal walls should be dry, but considerable crusting and redness will be present. If there is still rawness and weeping the wicks must be continued, and care should be taken that the treatment is being done properly.

After the acuteness of the condition has subsided under this therapy (usually 2 days, sometimes 3 or 4) there will be no subjective symptom of any importance. The patient must be impressed now with the necessity for continued therapy in order to prevent a recurrence. This may be done by explaining that while the acute stage has passed there is still disease present and treatment must be continued until the canal epithelium is healthy and normal.

Now follows a search for a therapeutic agent which will eradicate the disease process in any particular case. Listed next and arranged in the order of their efficiency in the greatest number of cases are the materials we have found to be of value. We usually start with the first and if two daily applications, each following meticulous cleansing as described, do not produce a marked advance of the epithelium toward a healthy state, the next is used. We have not seen any case which has not been amenable to at least one of the preparations.

Formula No. 1:

	gm. or cc.
Salicylic acid.....	1.0
Ammoniated mercury.....	1.0
Rose water ointment.....	30.0
Mix.	

Formula No. 2:	<i>gm. or cc.</i>
Ammoniated mercury.....	1.0
Petrolatum.....	30.0
Mix.	
Formula No. 3:	<i>gm. or cc.</i>
Salicylic acid.....	1.0
Ethyl alcohol 95-percent to make solution.....	30.0
Formula No. 4:	
Sulfanilamide powder.	
This is best instilled with a powder blower.	
Formula No. 5:	
Sodium sulfadiazine ointment 5-percent.	
This is a new item in the Supply Catalogue.	
Formula No. 6:	<i>gm. or cc.</i>
Sulfathiazole powder.....	1.5
Petrolatum q. s. ft.....	30.0
Mix.	
Formula No. 7:	<i>gm. or cc.</i>
Salicylic acid.....	3.0
Ethyl alcohol 95-percent to make solution.....	30.0
Formula No. 8:	<i>gm. or cc.</i>
Thymol.....	0.6
Cresatin q. s. ft.....	30.0
Mix.	
Formula No. 9:	<i>gm. or cc.</i>
Ichthammol.....	1.2
Naphthalan.....	6.0
Zinc oxide.....	15.0
Starch.....	15.0
Petrolatum q. s. ft.....	60.0
Mix.	

(This preparation is not available at sea but is very effective in Group 3 cases.)

Formula No. 10:	<i>gm. or cc.</i>
Benzoic acid.....	1.0
Salicylic acid.....	1.0
Ethyl alcohol 95-percent to make solution.....	30.0

Benzoic acid was not available but we feel that this so-called "liquid Whitfields" would be of use in some cases.

Group 2.—The pathology here is a cellulitis of the deep tissues of the canal walls and must be treated systemically as well as locally. The systemic treatment includes bed rest, abundant fluids, and the administration of sulfadiazine orally, 1 gram 4 times daily, starting with an initial dose of 2 grams. Local treatment consists of dry heat applied with a partially filled hot-water bottle from which the air has been expressed. After 24 hours of this therapy the edema has usually subsided enough so that a wick may be inserted in the canal. The heat is stopped and the ear is cleansed gently with boric acid-ethyl alcohol solution, as previously described and a wick soaked

in metacresyl acetate (cresatin) is inserted. This aids further in reducing the edema and is renewed 3 times daily. The local and systemic treatments are both continued until the temperature has been normal for 24 hours and the edema and pain have disappeared. This may take from 2 to 4 days. When this has been accomplished there begins the protracted attempt to return the epithelium to a normal state. The preparations mentioned above are used in the same way here and of course the patient may be ambulatory while this is being carried out.

Occasionally patients are seen with moderate edema and cellulitis of the canal, but with no systemic manifestations. These ambulatory patients are treated with sulfadiazine and thrice-daily insertions of wicks soaked in cresatin, for 2 or 3 days, until the acute symptoms have subsided. The prolonged treatment must be continued until cure is accomplished.

Group 3.—Daily cleansing and application of one of the preparations mentioned under Group 1 will usually clean up these cases in from 4 to 10 days. There is a great tendency for recurrence here and the men must be urged to return if the itching is noticed again.

It should be noted that patients in Group 1 and Group 2 under treatment for their acute manifestations pass into stages essentially similar to those of Group 3 and must be treated as such. Persistence, careful cleansing, and close observation are necessary to re-establish a normal epithelial lining of the canal. We are convinced that cases responding slowly, or not at all, to therapy are not getting proper care. This has been proved on many occasions when I have personally cared for a stubborn case and have obtained almost immediate results. Hospital corpsmen must be taught the anatomy of the external ear and the technique of cleansing and treatment and must be watched constantly to see that the work is done properly. In spite of a high incidence of external otitis at daily sick call we have kept the number of Group 2 cases necessitating admission to the sick list down to eight in 1944. Education of the crew and conscientious treatment will aid tremendously in reducing the incidence of recurrences.

EFFICACY OF PENICILLIN OINTMENTS

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Very gratifying results have followed the local application of penicillin because it is an effective bacteriastatic and bactericidal agent of low toxicity to leukocytes and other cells and its activity is unimpaired in the presence of pus and autolytic products (1). The success achieved with its use in wet dressings, irrigations, and sprays on septic surfaces assured its further usefulness in ointment form.

A suitable ointment base was sought in order to assure even dispersion of the penicillin in the mixture as well as diffusibility to all parts of the lesion to be treated. This limited the choice to a lanolin-containing ointment or an oil-water emulsion base. The latter seemed preferable because Duemling (2) had demonstrated that such ointments had increased penetration and dispersion effects due to a lowering of intrafascial tension produced by the contained "wetting agents." The oil-water emulsion base has further proved to be more desirable because its detergent effect hastened the removal of bacteria while the grease-type ointments favored bacterial regrowth by acting as an impermeable grease glove (3). The water soluble bases were thought to be more satisfactory too, because they adhere to a wet surface, their consistency can be readily altered by the addition of water, and because they can easily be removed by water alone (4).

The early reports on the use of penicillin in ointments (1) (5) (6) described its use in strengths of 100 to 500 Oxford units per gram of an oil-water emulsion base containing Lanette Wax S. X. as a "wetting agent." Clinical trial with this formula indicated that it is of great value in all superficial types of skin infections as well as in certain deeper infections such as carbuncles, sycoses, and erysipelas (6).

Templeton et al. (7) in studying the effectiveness and stability of various types of penicillin ointments containing 500 units per gram was able to demonstrate a greater initial bactericidal activity for the nongreasy types of bases which included an oil-water emulsion, pectin washable gel, and Elkonite washable base. However, these forms of ointment displayed the least stability and for the most part quickly lost their antiseptic properties if they were not kept refrigerated. On the other hand, his investigations with White Ointment, U. S. P., petrolatum, and oxycholesterol petrolatum mixture showed that from 10 to 40 percent active penicillin could be recovered at the end of a month even if they had been kept at room temperature (22° C).

We had been investigating this same problem using 400 units of penicillin per gram in plain lanolin compared with the same amount in an oil-water emulsion base (8). The method used was that of Steiner (9), employing one-centimeter filter-paper disks impregnated with equal amounts of the ointment to be studied. The disks were placed on blood agar plates which had been previously streaked in criss-cross fashion with pure cultures of *Staphylococcus aureus*. The resulting zones of inhibition were measured after 24 hours of incubation.

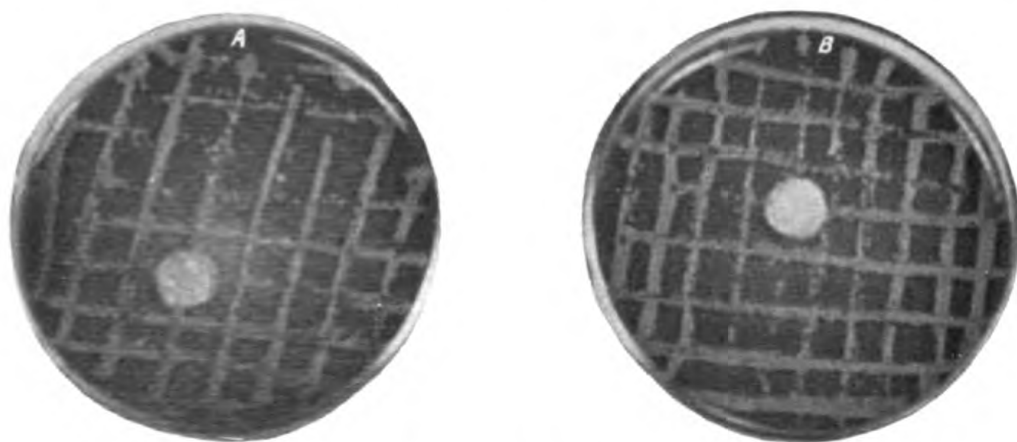
Our findings agree with those of Templeton in respect to the greater degree of bactericidal activity exhibited in fresh preparations of the emulsion base and the longer-continued activity of penicillin in the grease-type base if kept refrigerated. They differ, however, in that we found the bactericidal activity of both types of ointments to diminish at the same rate if kept at room temperature. These findings showed the potency to be retained longer than had previously been expected.

TABLE 1

	Diameter of zone of inhibition			
	Stored at room temperature (22° C.)		Stored in refrigerator (8° C.)	
	Novabase	Lanolin	Novabase	Lanolin
Start ¹	Cm. 3.8	Cm. 3.0	Cm. 3.8	Cm. 3.0
Days following preparation of ointment:				
Fourth day	3.5	2.5		
Ninth day	2.8	2.0	3.5	3.0
Seventeenth day	1.3	1.0	2.0	2.0
Twenty-sixth day	0	0	1.1	1.8
Thirty-second day	0	0	0	1.5
Forty-fifth day	0	0	0	1.25

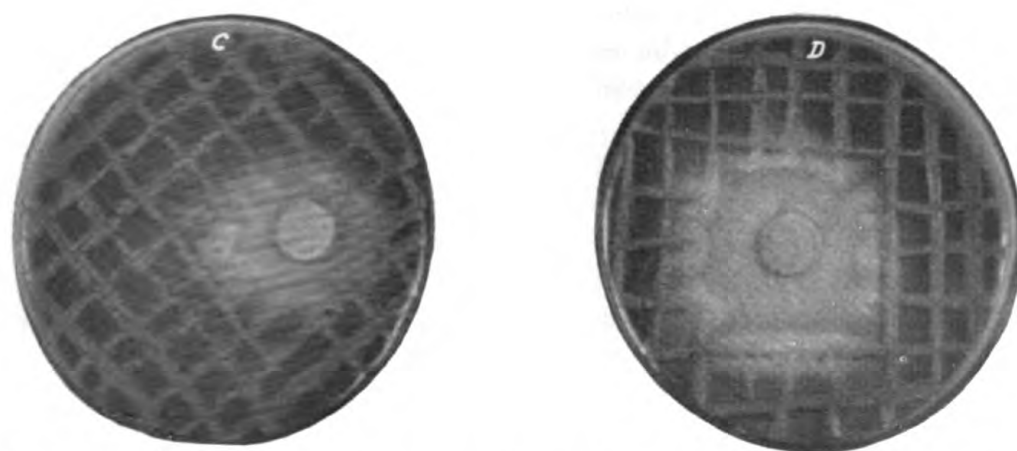
¹ Average measurements—5 plates. No inhibitory effect was found from plain lanolin or Novabase.

Our clinical trials to determine the efficacy of both types of ointment bases containing 400 units of penicillin per gram were carried out during the winter months at which time there is a seasonal increase in



1. Control Plate. No bactericidal effect from ointment bases alone.
(A) Lanolin (plain). (B) Novabase (plain).

nummular eczema. Since this skin disease is usually characterized by bilaterally symmetrical lesions and covered by impetiginous crusts, it lends itself very well to comparative local application experiments. Symmetrical areas were covered twice daily with the ointments to be compared and bandages applied. Each lesion was repeatedly treated with the base selected for that particular site and by this method daily observations were made of the comparative improvements. The results indicated that penicillin in the water-oil emulsion base was more rapidly efficacious and would remove all impetiginous crusting within 5 to 7 days. Slower but definite improvement was also observed following local therapy with penicillin in lanolin base.



2. Bactericidal effect of penicillin in ointment base. (C) Lanolin with penicillin.
(D) Novabase with penicillin.



3. Comparative effect of penicillin ointment; 5 days following treatment of nummular eczema.

Similar local-therapy experiments with other infectious skin diseases such as impetigo contagiosa and infectious eczematoid dermatitis produced the same results to confirm our findings. We agree with Templeton that further therapy with x-ray, local applications of tar ointments, dietary control, or vaccine therapy is necessary to clear up any underlying eczematous conditions.

It might be added that while wartime priorities restrict the use of essential ingredients of the oil-water emulsion base, our experience indicates that excellent results may be achieved using a lanolin-containing base such as the one selected by Cohen (10), employing lanolin and Unguentum Aqua Rosa, U. S. P. in equal parts. This has the advantage of maintaining its activity longer and will cover larger surface areas, which is important when smaller amounts are being used.

SUMMARY

1. Penicillin incorporated in an oil-water emulsion base is more rapidly efficacious in its antiseptic action than when used in a lanolin base.

2. The bactericidal activity of the penicillin deteriorates in 2 weeks in both types of ointment if kept at room temperature. Some antiseptic effect is still present at the end of 6 weeks in the lanolin base when kept refrigerated.

REFERENCES

1. FLOREY, M. E. and FLOREY, H. W.: General and local administration of penicillin. *Lancet* 1: 387-397, March 27, 1943.
2. DUEMLING, W. W.: Wetting agents: new synthetic chemicals of use in finer and more efficient tropical dermatologic therapy. *Arch. Dermat. & Syph.* 43: 264-280, February 1941.
3. PILLSBURY, D. M., LIVINGOOD, C. S., and NICHOLS, A. C.: Bacterial flora of normal skin; report on effect of various ointments and solutions, with comments on clinical significance of this study. *Arch. Dermat. & Syph.* 45: 61-80, January 1942.
4. BODENHAM, D. C.: Penicillin: Types of wounds suitable for treatment. *Brit. M. J.* 2: 655, November 20, 1943.
5. CLARK, A. M., COLEBROOK, L., GIBSON, T., THOMSON, M. L., and FOSTER, A.: Penicillin and propadimine in burns. *Lancet* 244: 605-609, May 15, 1943.
6. ROXBURGH, I. A., CHRISTIE, R. V., and ROXBURGH, A. C.: Penicillin in treatment of certain diseases of skin. *Brit. M. J.* 1: 524-528, April 15, 1944.
7. TEMPLETON, H. J., CLIFTON, C. E., and SEEBURG, V. P.: Local application of penicillin for pyogenic dermatoses. *Arch. Dermat. & Syph.* 51: 205-208, March 1945.
8. PILLSBURY, D. M., SHAFER, B., and NICHOLS, A. C.: Bacterial flora of normal skin; study of effect of sulfathiazole and some ointment bases. *J. Invest. Dermat.* 5: 371-379, December 1942.
9. STEINER, M.: Gram-negative bacilli: susceptibility to penicillin. *U. S. Nav. M. Bull.* 44: 486, March 1945.
10. COHEN, T. M. and PFAFF, R. O.: Penicillin in dermatological therapy; report of results in 100 cases. *Arch. Dermat. & Syph.* 51: 172-177, March 1945.



OPIUM ALKALOID AND VITAMIN C DEFICIENCY

After administration of opium alkaloids, the vitamin C concentration in various organs, particularly the lung, liver, and spleen, is decreased.—FROMMEL, E., PIQUET, J., CUÉNOT, C. L., LOUFI, M., and ABON, J.: Opium alkaloid and vitamin C deficiency. *Helvet. physiol. et pharmacol. acta* 3: 83-90, 1945; *British Abstracts, AIII—Physiology, Biochemistry, Anatomy*, December 1945, p. 874.

INTRADERMAL TESTS WITH "DIROFILARIA IMMITIS" ANTIGEN AS A DIAGNOSTIC AID IN HUMAN FILARIASIS¹

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Filariasis, infestation with *Wuchereria bancrofti*, has been a problem to the armed forces serving in endemic areas in the Pacific, especially in the Samoan and Wallis groups. King (1) stated that about one-fifth of the troops stationed on one island were admitted to a hospital with clinical manifestations of the disease. Although Coggeshall (2) and Michael (3) believe that permanent physical damage is unlikely in the vast majority of cases, minor signs and symptoms may persist for years. In view of the fact that many thousands of young men who have been exposed to filariasis in the Pacific are now being returned to civilian life, the problem of diagnosis is of concern to physicians generally.

Diagnosis is often difficult. The demonstration of circulating microfilaria or of adult worms in tissue obtained at biopsy would prove infestation beyond all doubt. The presence of calcification in lymph glands shown by x-rays is suggestive evidence when associated with a history or physical findings indicating filariasis. In light infestations, which are the rule in returning servicemen, however, microfilaria are almost never found, gland biopsies seldom reveal adult worms, and calcified areas in lymph glands can rarely be demonstrated. Therefore, diagnosis in most cases must depend upon a history of exposure in endemic areas and characteristic signs and symptoms. Retrograde lymphangitis of arms and legs, lymphangitis of the spermatic cords, lymphadenopathy, especially of the epitrochlear,

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axillary, and postcervical regions, transient, localized swellings of arms and legs, swelling of testicles, and hydrocele all may be caused by filariasis. But in spite of the finding of one or more such signs, the diagnosis may still be in doubt and skin tests may provide additional valuable evidence. It is the purpose of this study to appraise the diagnostic value of skin tests with extracts of *Dirofilaria immitis*, the dog "heart-worm."

HISTORICAL BACKGROUND

Skin testing with extracts of *D. immitis* in cases of human filariasis was first investigated by Taliaferro and Hoffman (4) in Puerto Rico. They used a saline extract of dried worms in a dilution of 1:200, injecting intradermally 0.025 cc. to make the smallest possible wheal. For control material they employed extracts of filariid worms from monkeys, extracts of normal snail "liver," and physiological saline solution and excluded from their analysis of results, positive reactors to any of these. The size of the wheal, the presence of pseudopods and a surrounding zone of erythema were considered in the interpretation of results. In a group of 23 persons with filariasis, proved by the demonstration of microfilaria in the blood, they found skin tests positive in 83 to 96 percent, depending upon the criteria for a positive result (table 1). In another group of 56 persons, residents of areas where filariasis was endemic, the tests were positive in 68 to 93 percent, or only slightly less than the positive reactors in proven cases. Another control group of 22 persons, residents of the United States who had lived in the South or had visited known filaria-endemic centers, gave positive results in 5 to 32 percent. In a third control group of 19 persons who probably had never been exposed to filariasis, tests were positive in 0 to 11 percent. Delayed positive reactions were seldom encountered.

Fairley (5), at about the same time, and independently, also used saline extracts of *D. immitis* and found that six of seven cases of filariasis, all of six cases of *Loa loa* infestation, and one case of onchocerciasis gave positive results (table 1). In a few patients a 1:100 dilution of antigen was employed but severe generalized reactions developed in some and subsequently a 1:1,000 dilution was used. Marked delayed reactions were noted in most cases after several hours and were described as deep "blubbery" swellings.

Rodhain and Dubois (6) used a saline extract of *D. immitis*, in a dilution of 1:200 in testing 27 Europeans. They found positive results in nearly all those infested with *Loa loa*, *Acanthocheilonema perstans* or *Onchocerca volvulus*. Only one of the remaining 15 persons, all presumably free from any type of filarial infestation, reacted positively. In this case the development of the wheal was slower than

TABLE 1.—Summary of data. Skin testing with *Dirofilaria immitis* antigen

Name of observer	Dilution of antigen	Volume injected	Criteria for positive results	Results of tests			
				Filariasis cases		Control	
				Number of cases	Per-cent positive	Num-ber of cases	Per-cent positive
Taliaferro and Hoffman.	1:200	0.025 cc.	Wheal, 5 or more mm. and negative reaction to one other parasitic extract.	23 ¹	96	56 ² 22 ³ 19 ⁴	93 32 11
			Wheal plus pseudopods and negative reaction to one other parasitic extract.	23 ¹	83	56 ² 22 ³ 19 ⁴	68 5 0
			Wheal, 10 or more mm., or wheal plus pseudopods and neg. reaction to one other parasitic extract.	23 ¹	91	56 ² 22 ³ 19 ⁴	82 5 0
Fairley.....	(1:100 few) 1:1,000	0.25 cc.	Wheal not less than 2.5 cm., with out-runners and surrounding zone of erythema.	6 (<i>L. loa</i>) 7 1 (<i>O. volvulus</i>)	100 86 100	Not given. No positives in persons not exposed.	
Rodhain and DuBois.	1:200	0.25 cc. 0.2 cc. 0.1 cc.	Wheal not less than 2 cm., pseudopods, erythema.	6 (<i>L. loa</i>) 3 (<i>A. perstans</i>) 3 (<i>O. volvulus</i>)	100 100 67	15	7
Bozicevich and Hutter.	1:8,000	0.01 cc.	Wheal at least 3 mm., larger than controls. ⁵	25	100	11 6	0 0
King.....	1:1,000	0.1 cc.	A definite wheal with surrounding erythema.	"A" antigen 108 ⁶ "B" antigen 164	68 91		2.6 10.5
Huntington.....	1:10,000 1:1,000 1:200	0.25 cc.	A 30-minute wheal of 15 mm. or more, followed by 24-hour area of edema at least 30 mm., with 1:200 antigen, or 20 mm. with diluted antigen.	202	83		5

¹ 23 patients with circulating microfilaria.² 56 residents of endemic areas.³ 22 persons possibly exposed to filariasis.⁴ 19 persons probably never exposed to filariasis.⁵ Controls saline, dog protein antigen, and trichina spiralis antigen.⁶ "B" antigen, stronger initial extraction.

in the other positive reactors. Among the negative reactors was one suffering from vesicle schistosomiasis. As in Fairley's cases, delayed reactions of deep subcutaneous swellings were a prominent feature.

Bozicevich and Hutter (7), after testing increasing dilutions of saline extracts of *D. immitis* concluded that a dilution of 1:8000 was more specific, caused fewer false-positive reactions, and was safer than stronger dilutions. They used only 0.01 cc. as a test dose. For control antigens they employed dog protein, *Trichina spiralis* extracts and saline. Results were interpreted as positive when a wheal developed at the site of inoculation of the test antigen which was at least 3 mm.

larger than those produced by any of the controls. Otherwise the test was interpreted as negative. They found that all of 25 cases of clinical filariasis gave positive results. Several reacted with small wheals with dog protein, and 2 patients developed wheals at least 3 by 3 mm. in size with trichina antigen but in all cases the *D. immitis* wheals were sufficiently larger to be classed as positive. In 11 control individuals with some type of allergy the filariasis skin test was interpreted as negative in all cases although one developed wheals 3 by 4 mm. in size with both the filaria and dog protein antigens. The results in all of 6 patients with malaria were interpreted as negative although in one wheals of 3 by 4 mm. developed with filaria and dog protein antigens. The authors did not state whether the control groups had any exposure to filariasis, but it is probable that the malaria patients had been exposed because they were servicemen who had returned from overseas duty.

King used two types of *D. immitis* antigen, which he labelled "A" and "B," in doses of 0.1 cc. 1:1,000 dilution, the difference in the antigens being that the initial extraction was stronger in the "B" antigen. In cases of clinical filariasis, in none of which were microfilaria demonstrated, about 68 percent reacted positively to "A" antigen and 91 percent to "B" antigen. In presumably noninfected controls about 3 percent reacted to "A," and 10 percent to "B" antigens. Results were interpreted as positive if a definite wheal with a surrounding area of erythema developed within 8 to 10 minutes (immediate reaction), or if, within 24 hours, there was an area of erythema greater than 1.5 cm. in diameter, with associated subcutaneous edema (delayed reaction). Results were recorded from 1 plus to 4 plus according to the following:

Immediate reactions (10 minutes)

- 1 plus_____ erythema only.
- 2 plus_____ erythema plus a definite wheal.
- 3 plus_____ erythema, wheal with pseudopods.
- 4 plus_____ erythema greater than 5 cm., wheal with pseudopods.

Delayed reactions (24 hours)

- 1 plus_____ erythema greater than 1.5 cm.
- 2 plus_____ erythema with mild or moderate subcutaneous edema
of rubbery consistency.
- 3 plus_____ erythema with marked subcutaneous edema.
- 4 plus_____ erythema greater than 5 cm. with subcutaneous edema.

Those which were classed as 2 plus or greater, either immediate or delayed reactions, were called positive. There were delayed positive reactions in about 40 percent of filariasis patients. Physiological

saline was used for controls in the first 300 tests and was then abandoned because in no case did the saline control produce a reaction comparable to a positive test with the antigen. An occasional patient had a severe delayed reaction with swelling of the entire arm and hand resembling cellulitis and persisting for 3 to 7 days.

Huntington (8) used saline extracts of dried *D. immitis* in dilutions of 1:10,000, and 1:1,000, and 1:200, given in doses of 0.25 cc. His standards for a positive reaction were a 30 minute wheal of 15 mm. or larger, followed by a 24 hour area of edema of at least 30 mm. with the 1:200 dilution or at least 20 mm. with the more dilute antigens. In cases of clinical filariasis he found 83 percent, and in presumably noninfested controls 5 percent reacted positively. The number of positive reactions increased with the strength of the antigen.

Wright and Murdock (9) employed *D. immitis* antigen in testing 20 onchocerciasis patients. Reactions were considered to be positive when the diameter of the antigen wheal exceeded by 3 mm. or more that of the canine serum, or physiological saline control wheals. All 20 onchocerciasis patients reacted positively to 0.1 cc. of a 1:2,000 dilution of the antigen and of 11 patients, tested with a 1:4,000 dilution, 10 reacted positively. Sixteen individuals who had never been near endemic zones of onchocerciasis were similarly tested. Nine reacted positively to the 1:2,000 dilution and 7 reacted positively to the 1:4,000 dilution. Most of the onchocerciasis patients and all the control individuals were infested with some type of intestinal round worm, and the authors suggest that at least part of the positive reactions in both groups were due to helminth-group reacting factor in the antigen. They concluded from the control tests with canine serum antigen that false-positive reactions were not likely to be caused by the small amount of host protein which might be contained in the *D. immitis* antigen.

Antigens prepared from other members of the filarial group have been used in skin testing. Culbertson, et al. (10) prepared a saline extract of *Litomosoides carinii*, a filarial worm found in the cotton rat, and found positive tests in 81 percent of 81 men suspected of having filariasis. Using the same antigen, they (11) obtained positive tests in 2 patients with onchocerciasis and in 2 with loiasis, and negative tests in 38 of 40 controls. They considered wheal formation with a surrounding area of erythema as positive reaction.

OBSERVATIONS

The observations reported here were made on male patients in the U. S. Naval Hospital, Bethesda, Md., from December 1944 to September 1945. Three groups of patients were studied: First, those with a clinical diagnosis of filariasis; second, those without a clinical diag-

nosis of filariasis but who had been exposed to infestation in the Pacific area, most having been sent to the hospital because of malaria; and third, a control group of patients who probably had not been in filaria-endemic areas.

There were 117 patients in the filariasis group. They had been sent to the hospital or were referred to the Tropical Diseases Service because a diagnosis of filariasis had been made at some time since exposure in the Pacific. In most cases further studies here substantiated the diagnosis but in several they remained in doubt. The patients were skin tested in order as they were sent to us without any attempt at selection.

There were 155 patients in the exposed group who were likewise tested in order as they appeared.

There were 117 patients in the group probably not exposed to filariasis. These were chosen at random from other wards in the hospital, the only basis for selection being that they had never lived in known filaria-endemic areas outside the United States. Many were being treated for gastrointestinal complaints, some for allergies, and some for pulmonary disease.

The antigen employed was a saline extract of dried *D. immitis* worms in a 1:10,000 dilution, prepared according to methods described by Dr. John Bozicevich elsewhere (6). In every case 0.1 cubic centimeter of antigen was injected intradermally over the flexor surface of 1 forearm. Results were recorded after 10 minutes and again the following day, usually after 24 hours. No control antigens were used. The interpretation of results followed that of King (already described) and were recorded as 1 plus to 4 plus. Any reading of 2 plus or greater, i. e., any reaction showing at least definite wheal formation with erythema in 10 minutes, or erythema with edema after 24 hours, was classed as positive.

RESULTS

Table 2 records the results of skin tests on 389 patients. In filariasis patients tests were positive in nearly 72 percent. Among the positive reactors only 4 gave positive delayed reactions in the absence of positive immediate reactions. In the group exposed to filariasis 27 percent reacted positively and in the nonexposed controls about 9 percent of tests were classed positive. If all 2-plus reactions were excluded from positive readings, the percentage of positive reactors would be 59 for filariasis patients, 20 for the exposed group, and about 4 for those not exposed.

Delayed reactions were uncommon. Reactions after 24 hours of 2 plus or more occurred in 21 of the filariasis group, but in only 4 of

TABLE 2.—*Results of skin tests with 0.1 cc. of 1:10,000 D. Immitis antigen*

Reaction	Patients with diagnosis of filariasis		Patients exposed to filariasis		Patients without known exposure	
	Number	Percent	Number	Percent	Number	Percent
2 to 4 plus immediate.....	80	68.4	38	24.5	11	9.4
0-1 plus immediate 2-4 plus delayed.....	4	3.4	4	2.6	0	0
Total with 2 to 4 plus.....	84	71.8	42	27.1	11	9.4
Total with no reading more than 1 plus.....	33	28.2	113	72.9	106	90.6
Total.....	117	100.0	155	100.0	117	100.0

them was the immediate reaction less than 2 plus. In the exposed group there were 8 with delayed reactions of 2 plus or greater and in 4 of these the immediate reaction had been less than 2 plus. In the unexposed group only 1 reaction was positive in 24 hours. This was classed as 2 plus only, at both the 10-minute and 24-hour readings. Only a few patients developed rubbery swelling of the arm associated with pain. Edema present after 24 hours persisted for more than 2 or 3 days in only a few. In no case was there any generalized reaction or noticeable exacerbation of signs of filariasis.

In general the tests were more strongly positive in the filariasis and exposed groups. There were only 5 of the unexposed patients who showed as much as a 3-plus reaction but the great majority of positive reactions in the other 2 groups were classed as 3 plus or 4 plus.

Results in a selected group of filariasis cases.—A special analysis was made of the records of 23 patients who had the most definite signs of filariasis and in whom a positive diagnosis could be made on clinical findings of acute lymphangitis of extremities, or of spermatic cords, or circumscribed soft tissue swellings. In many of them there was epitrochlear, axillary or post-cervical adenopathy without obvious cause. In 2, soft tissue calcifications, probably resulting from filarial worms, were demonstrated by x-ray. In 3 patients, 2 of them Virgin Islanders and 1 a Samoan, microfilaria were repeatedly found in the peripheral blood, and the Samoan had elephantiasis of 1 leg.

Skin tests were positive in 22 or 96 percent. The reaction was recorded as 4 plus in 18, as 3 plus in 2, as 2 plus in 2, and as completely negative in 1. In 3 patients with circulating microfilaria the skin test was 4 plus in 2 and 2 plus in the other.

Tests in allergic individuals.—Thirty persons in the unexposed group gave a definite history of hives, hay fever or attacks of asthma. One of them, a patient with a history of hives in the past, reacted positively to the antigen (3-plus immediate result). None of the rest showed any reaction, all being recorded as 0 in both immediate and

24-hour reading. This is in agreement with the findings of Bozicevich and Hutter already mentioned, and suggests that allergy alone does not cause skin sensitivity to extracts of *D. immitis*.

Results in individuals with intestinal worms.—The results of stool examinations were recorded in 49 filariasis patients. Thirteen of them showed ova of helminths, 6 of hookworm, and 7 of trichuris. Positive filaria skin tests were found in 12 of the 13, or 92 percent. In the 36 patients with negative stool examinations skin tests were positive in 29, or 81 percent. The figures are too small for the difference to be statistically significant.

In the exposed group, stool examinations were recorded in 141 patients. In 22 cases showing helminth ova in the stools (hookworm in 19 and trichuris in 3) skin tests were positive in 6, or 27 percent, and negative in 16, or 73 percent. In those with negative stool findings, 28, or 26 percent of the skin tests were positive, and 81, or 74 percent were negative.

Stool examinations were recorded in 84 persons unexposed to filariasis. In only 2 were helminth ova found, hookworm in both, and in both, skin tests were positive. One was recorded as 4 plus, the other as 2 plus.

In 17 patients with either hookworm or trichuris infestations, the skin tests were entirely negative. There does not appear to be a marked difference in the sensitivity to *D. immitis* antigen in individuals with or without intestinal worms.

Relation of skin tests to degree of exposure.—Coggeshall stated that in a large series of cases of filariasis in Marines, 96 percent had been stationed in the Samoan group of islands and that only 4 percent contracted the infection elsewhere. This is in general agreement with our experience here and suggests that the risk is greater in the Samoan group than in the other Pacific areas where our armed forces have been stationed. The reason for this may be because of more intimate contact with native Samoans, and because the microfilaria are circulating both day and night in the Samoan area. In the filariasis patients in this study about 81 percent of those who had been stationed on Samoa reacted positively to the filaria skin test, while only 45 percent of those who had not been on Samoa gave positive tests. Among the group without a diagnosis of filariasis, 40 percent of those exposed in Samoa gave positive skin tests, while among those exposed elsewhere only 25 percent reacted positively (table 3). These findings suggest that skin sensitivity to *D. immitis* antigen increases with the degree of exposure.

Relationship between eosinophile percentage and skin tests.—The percentage of eosinophiles in differential blood counts was found to be

TABLE 3.—*Results of skin tests in individuals with or without known exposure in Samoa*

Patient group	Exposure in Samoa		No exposure in Samoa	
	Number of cases	Percent with positive skin tests	Number of cases	Percent with positive skin tests
Filariasis.....	70	81.5	22	45.5
Exposed only.....	25	40.0	126	25.4

considerably higher in filariasis patients and moderately higher in the exposed group than in those not exposed. Table 4 shows that about 37 percent of the filariasis cases, 16 percent of the exposed group, and only 5 percent of those not exposed to filariasis had eosinophile counts of more than 5 percent. Part of the difference may be explained on the basis of more infestations with intestinal worms in the group who had overseas service, but in those with negative stool examinations eosinophile counts in excess of 5 percent were found in 18.5 percent of 27 filariasis patients, in 12 percent of 108 of the exposed group, and in only 5 percent of 101 unexposed persons. Furthermore, in patients with positive skin tests, the percentage of eosinophiles was greater than in those with negative tests in both the filariasis and the exposed groups. Considering these two groups together, 20 percent of positive reactors and 10 percent of negative reactors had eosinophile counts in excess of 5 percent.

TABLE 4.—*Percent distribution of eosinophile percentages in filariasis patients, in persons exposed to filariasis, and in those without known exposure*

Percent of eosinophiles in differential counts	Patients with diagnosis of filariasis, percent	Patients exposed to filariasis, percent	Patients without known exposure, percent
0-2.....	33.4	59.7	79.6
3-5.....	29.4	24.5	15.5
6-9.....	27.4	10.1	4.9
10-14.....	5.9	4.3	0
More than 15.....	3.9	1.4	0
Total number in group.....	51	139	108

DISCUSSION

It is apparent that in individuals infested with members of the Filariidae family of round worms there is a common type of skin reaction to extracts of *D. immitis*. Skin tests with *D. immitis* antigens have been positive in practically all persons known to be infested with *W. bancrofti*, *L. loa*, *Onchocerca volvulus*, and *A. perstans*.

Saline extract antigens have been used in dilutions varying from 1:100 to 1:10,000 and in amounts from 0.01 cc. to 0.25 cc. Positive skin reactions, however, have been qualitatively similar, differing only in

the degree of reaction. Within the range of dilutions and dosages used thus far, there is no evidence that larger amounts of antigen are of greater diagnostic help than smaller amounts. In fact, larger quantities often produce severe reactions and may result in an increased number of false-positives.

The interpretation of reactions has also varied considerably with different investigators. Some accept as positive, reactions showing only a definite wheal with surrounding erythema within 10 minutes, with or without the development of a delayed reaction. Others have required that a positive test must consist of a wheal of minimum size, with pseudopods and surrounding erythema, within 10 minutes, followed by a delayed development of subcutaneous edema. Many have required also that tests with various control antigens and with saline show no reaction or a reaction smaller than that produced by the test antigen. From a study of the available information, however, it seems warranted to conclude that the development within 10 minutes of a definite wheal with surrounding erythema, regardless of size, pseudopods, edema, or delayed reaction, indicates a skin which is sensitive to *D. immitis* substances and should be regarded as a positive test.

The mechanism of the production of sensitivity to the antigen is not understood. Apparently, however, infestation with any of the *Filariidae* will produce such a reaction. The simultaneous development of positive skin tests with *D. immitis* antigen and with other substances such as dog protein, trichina antigen, or ascaris antigen, does not necessarily mean that there is a common factor and that one is positive because the other is positive. Individuals have shown positive reactions to trichina antigen, to dog protein, and to ascaris antigen, to mention but a few, but have reacted negatively to *D. immitis* antigen.

The occurrence of "false" positive reactions in individuals who have not known exposure to the *Filariidae* remains to be explained. It has been suggested (8) that infestation with nematodes other than the *Filariidae* may cause skin sensitivity to *D. immitis* substances but there is little evidence to support such a contention. There were 17 individuals in our group who reacted negatively to *D. immitis* antigen in the presence of infestation with hookworm or trichuris. Taliaferro and Hoffman suggested that infestation of man with *D. immitis* might be a cause, because there are many areas in the United States where the incidence of infestation of dogs is high. Exposure to *W. bancrofti* may actually have occurred to explain positive reactions in the absence of known exposure. Filariasis is endemic in parts of our Southern States and in 1919 in Charleston, S. C., among 400 persons examined, 77, or nearly 20 percent, were found to have circulating micro-

filaria. Cases of filariasis have been reported originating as far north as Washington, D. C. (12). Thus exposure to filariasis and actual infestation with a few or many worms is probably not uncommon and may account for many unexplained positive skin reactions to *D. immitis* antigen.

Skin testing with *D. immitis* antigen is doubtless a valuable aid in the diagnosis of filariasis and may be highly specific. In practically all cases of *proven* infestation with *W. bancrofti*, tests have been positive. The correlation between increasing risk of infestation and the percentage of positive reactors, is high. The correlation between high eosinophile counts, risk of infection, and positive reactors further substantiates the specificity of the test. On the contrary, skin reactions have been positive in only a small proportion of persons probably unexposed to filariasis.

Further studies should be carried out to clarify debatable points. The preparation, strength and volume of antigen employed, and the criteria for positive reactions should be standardized. The cause of positive tests in the absence of known exposure to the *Filariidae* should be investigated. More exact knowledge of the epidemiology of human and canine filariasis is desirable to correlate with skin tests.

CONCLUSIONS

1. Skin sensitivity to extracts of *D. immitis* is present in most persons known to be infested with round worms of the filarial group.
2. Skin sensitivity to extracts of *D. immitis* is absent in most persons believed to be free from infestation with filarial worms.
3. Intradermal tests with 0.1 cc. of a 1:10,000 saline extract of *D. immitis* are a valuable aid in the diagnosis of filariasis.

REFERENCES

1. KING, B. G.: Early filariasis diagnosis and clinical findings; report of 268 cases in American troops. *Am. J. Trop. Med.* 24: 285, September 1944.
2. COGGESHALL, L. T.: Malaria and filariasis in the returning serviceman. *Am. J. Trop. Med.* 25: 177-184, May 1945.
3. MICHAEL, P.: Filariasis: Histopathologic study. *U. S. Nav. M. Bull.* 45: 225-236, August 1945.
4. TALIAFERRO, W. H. and HOFFMAN, W. A.: Skin reactions to *Dirofilaria immitis* in persons infected with *Wuchereria bancrofti*. *J. Prev. Med.* 4: 261-280, July 1930.
5. FAIRLEY, N. H.: Serological and intradermal tests in filariasis; preliminary report. *Tr. Roy. Soc. Trop. Med. & Hyg.* 24: 635-648, April 1931.
6. RODHAIN, J. and DUBOIS, A.: Contribution to study of intradermal reactions in human filariasis. *Tr. Roy. Soc. Trop. Med. & Hyg.* 25: 377-382, March 1932.
7. BOZICEVICH, J. and HUTTER, A. M.: Intradermal and serological tests with *Dirofilaria immitis* antigen in cases of human filariasis. *Am. J. Trop. Med.* 24: 203-208, May 1944.

8. HUNTINGTON, R. W., JR.: Skin reactions to *Diroflaria immitis* extract. U. S. Nav. M. Bull. 44: 707-717, April 1945.
9. WRIGHT, W. H. and MURDOCK, J. R.: Intradermal reactions following use of *Diroflaria immitis* antigen in persons infected with *Onchocerca volvulus*. Am. J. Trop. Med. 24: 199-202, May 1944.
10. CULBERTSON, J. T., ROSE, H. M., and DEMAREST, C. R.: Loiasis and onchocerciasis: new antigen for their diagnosis by skin test. Am. J. Hyg. 39: 152-155, March 1944.
11. CULBERTSON, J. T., ROSE, H. M., and DEMAREST, C. R.: *Filariasis bancrofti*: its diagnosis by immunological tests with antigen derived from *Litomosoides carinii*. Am. J. Hyg. 39: 156-162, March 1944.
12. STRONG, R. P.: Stitt's Diagnosis, Prevention, and Treatment of Tropical Diseases. Vol. II, 6th edition. The Blakiston Co., Philadelphia, 1943. p. 1298.



INDUCED SENSITIVITY FROM TOPICAL USE OF SULFONAMIDES AND PENICILLIN

In the author's opinion there is no question of a doubt that these reactions are increasing, and if one could question the millions of people who have used the sulfonamides locally, through either lay or professional advice, examples of induced sensitivity would be found so frequently that the present figures would appear ridiculously small, and future deaths from severe general septic infections correspondingly great because of inability to use these life-saving drugs owing to sensitivity induced years before. There is no logic in such a procedure, and it is our duty as dermatologists to hammer the above-mentioned facts into the nondermatologic mind. These facts can be summed up as follows:

1. Avoid the local use of sulfonamides in trifling cutaneous lesions, reserving them for serious coccal skin infections.
2. Limit their use for a period no longer than 7 days.
3. During their application instruct the patient to avoid solar and quartz lamp exposures.
4. Despite the fact that patch testing is recommended and is frequently used to determine sensitivity to the sulfonamides, it must be kept in mind that a patch test can occasionally cause a severe flare-up far worse than the original dermatitis.

Allergic manifestations following the use of penicillin up to date have been both mild and rare. In estimating their number and characteristics, one should be careful not to include the recurrent papulo-vesicular eruptions appearing after the administration of penicillin in patients with an antecedent chronic dermatophytosis of the feet, either with or without a vesicular dermatophytide of the hands. These eruptions . . . occur within 24 hours and are not allergic manifestations, but may be due to some form of immunologic disturbance, possibly induced by the sudden and increased liberation of toxins from foci of the antecedent dermatologic condition.—BECHER, P. E.: Induced sensitivity from topical use of sulfonamides and penicillin. Pennsylvania M. J. 49: 417-420, January 1946.

OCCLUSAL BALANCE IN FULL DENTURE PROSTHESIS

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The full denture problem has been, and probably will continue to be, one of the dentist's most intriguing professional interests. Its solution has long been known to consist of three basic requirements, namely, esthetics, comfort, and efficiency, and has presented a constant challenge to the ingenuity of the dentist.

It is reasonably conceded that the advent and usage of dental plastics has contributed to great progress toward achievement of the esthetic phase when the proper anterior teeth are selected and arranged to present a natural appearance. Comfort is obtained relatively easily by the several processes of construction, topped by the all important elimination of occlusal trauma. The latter is accomplished by occlusal balance, which factor, if truly existent, will provide for the third requirement—efficiency.

It is the purpose of this article to describe a method which it is believed makes it possible for any dentist to deliver balanced dentures. The procedure is so fundamentally simple and logical that it is at once comprehensible. It is not intended, by any means, to convey the thought that here at last is perfection, nor the solution to all denture problems, nor a new discovery. It is contended that, in dentures not otherwise faulty, this technique will establish occlusal balance. Readers are urged to conscientiously experiment with this procedure in several cases, closely adhering to the instructions as herein outlined. Considerable benefit for the patient will be obtained and an amazing view of what had been accepted as occlusal balance will be revealed to the operator.

It is a well-known fact that all dentures undergo a dimensional change in processing, particularly in full upper and lower cases. Various techniques have been employed to keep this change at a minimum, some of which are moderately successful. In nearly every case, when the dentures are inserted, the patient and the dentist feel that a little cuspal adjustment is necessary, which is usually accomplished by spot grinding and oral mill-in. The opinions of the patient, based on

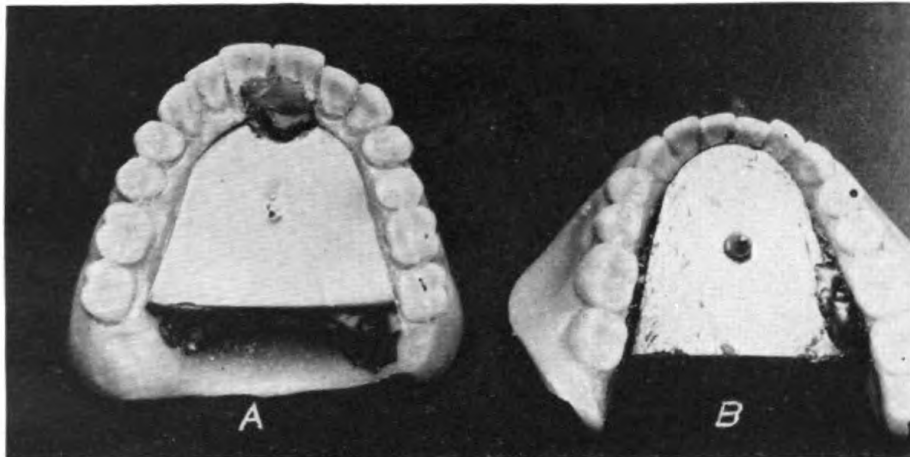


FIGURE 1.

“feel,” and of the dentist, based on vision through use of carbon paper check, etc., are worthless, nevertheless sincere, as it is possible to make such decisions only through the accuracy of unbiased scientific instrument measurement and analysis. As a matter of fact most dentures look quite satisfactory. It is believed to be impossible to correct the balance fault by spot grinding and oral mill-in because dentures cannot be fully seated until occlusal pressure is equipoised.

It is a physical truth that tripod pressure is equally distributed and therefore is in balance. The two condylar heads plus the dentures form a tripod is agreed. The pressure of the denture leg of the tripod is concentrated by centering it in pin-point contact between the dentures. This is accomplished by centrally mounting a bearing pin in the median line antero-posteriorly in a convexly curved plate secured to the lower denture, the pin point striking a flat plate attached in the vault of the upper denture. The latter step also insures that the upper denture is truly “seated” upward and the lower denture simultaneously “seated” downward, which denture positions are requisite in occlusal balance. The actual procedure is next described.

1. A flat, thin, sheet-metal plate with a flange at the posterior area (to provide angular reinforcement for rigidity) is secured horizontally in the denture vault by luting with stick compound (fig. 1A).

2. A curved plate, with a $\frac{3}{16}$ -inch screw centrally mounted therein, is attached to the lingual flange of the lower denture with stick compound. (This plate is readily obtained by cutting off the forward two-thirds of an ordinary tablespoon, boring a hole in the center, soldering a $\frac{3}{16}$ -inch nut to it, which will permit the central bearing screw to be controlled (fig. 1B). The screw pin is raised to a position where there will be no cuspal interference either in centric, protrusive, or lateral movements.

3. Insert the dentures and have the patient go through several protrusive and lateral excursions of the mandible which effort will trace a Gothic arch on the flat metal plate mounted on the upper denture (figs. 2 and 1A).



FIGURE 2.

4. Lateral check bites are made in soft wax, using green for right and red for left, and laid aside for future usage.

5. Remove the upper denture and drill a small hole at the apex of the Gothic arch tracing (centric). Attach face bow fork to upper denture. The denture is reinserted and the patient instructed to slide the pin into the hole and to retain this position securely. The dentures are locked together in this centric position with Solvite, Plastogum, or some such material, which is allowed to fully harden.

Note.—A "plaster gun" can be readily made by forming a cone out of an ordinary typewriter-size sheet of paper, the apex being an opening no greater than $\frac{1}{2}$ -inch in diameter and the base about 3 inches in diameter; secure this cone by the use of staples or tape, etc. Mix Solvite, Plastogum, etc., and fill cone about two-thirds full; bend base over to act as seal, grasping between fingers of one hand, place apex between incisal edges of the dentures and compress cone with other hand to expel sufficient plaster material to produce desired lock.

6. Secure face bow to fork and remove locked dentures, as a unit if at all possible to do so, and mount on articulator (fig. 3).

Note.—The incisal guide pin may be disregarded or removed altogether, if necessary.

7. The locking material (Solvite, Plastogum, or whatever is used) and the central bearing pin apparatus are removed.

8. The check bites obtained in soft wax are now used to determine the condylar inclination paths which are set on the respective articulator condyle recording devices (fig. 4). The occlusal balance discrepancy, if any, previously not discernible is now readily observed (fig. 5).

9. The grossly unbalanced areas are corrected by spot grinding, followed by milling with abrasive paste in centric, protrusive and lateral positions until complete freedom of movement is obtained.

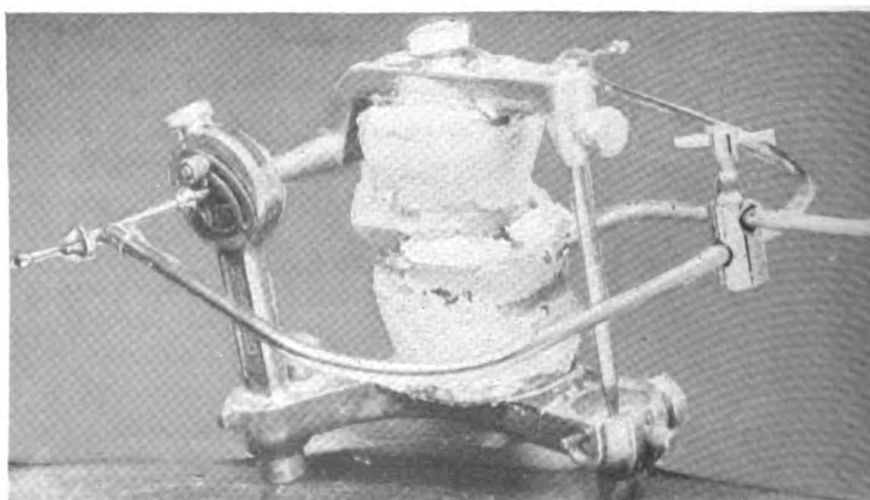


FIGURE 3.

Note.—A paste of pumice and vaselin is an excellent abrasive for acrylic teeth while carborundum paste is to be used for porcelain teeth.

10. The dentures are removed from the articulator, repolished and inserted in the patient's mouth.

Without exception patients immediately recognize the im-

provement upon closing, and in a moment or two will make some remark such as "Now they hit all over. I can slide back and forth which I could not do before." This is particularly true if the patients have been wearing badly unbalanced dentures as they can more readily sense the great correction and obvious improvement. The contrast between the unbalanced and the scientifically (not visually) balanced dentures is so marked that the patients now realize that previously they had not been provided with the two basic requirements—comfort and efficiency. In delivering a new case the patient will be more able to appreciate quality, and be extremely grateful for it, if the balancing

step is accomplished a few days following initial delivery as he will then have an opportunity to benefit from the aforementioned comparison. It is further suggested that once complete understanding of this procedure has been accomplished some full denture patients be recalled, the more unhappy ones in particular, and their dentures balanced. The result in each case will be well worth the time ex-

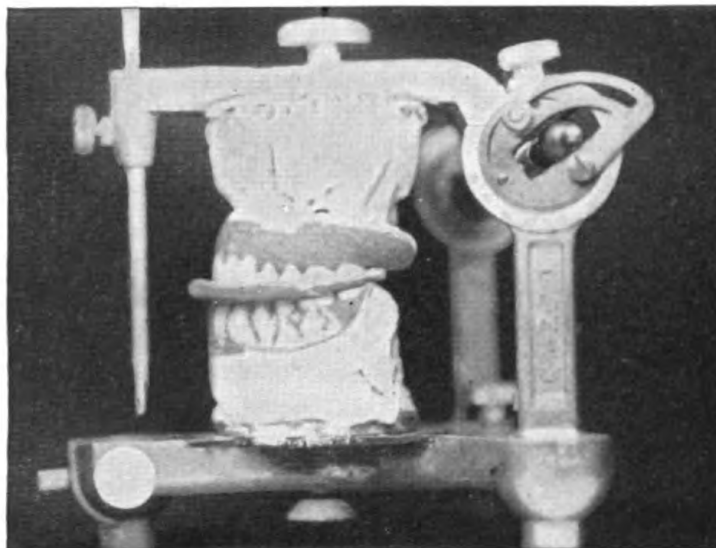


FIGURE 4.

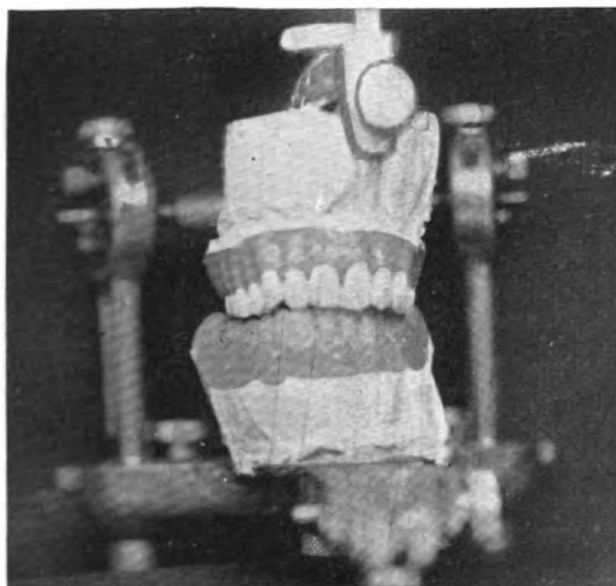


FIGURE 5.

pended. Most "sore spots" promptly disappear and the patient will insist that there is better stability and retention as well. Overextended peripheral border is a matter of faulty design, however.

Lt. Comdr. Hollis A. Askey (DC), U. S. N. R., having used this idea previously, established the thought of its use as outlined, at this activity and in collaboration with other personnel in the dental department developed the procedure as described. Lt. Joseph E. Hoffman (DC), U. S. N. R., presented a full denture clinic featuring the importance of occlusal balance and its accurate accomplishment by means of this technic at one of the professional clinical meetings which have been routinely held at this station.

It is believed that two major objectives have been accomplished by the foregoing described technic, namely delivery of efficiently useful dentures, and virtual elimination of several time-taking denture adjustments, and most important, groping in the dark in "trying it again" by making a new case. Upon each occasion that a completed case returns for any service that period of time is lost to the dentist and therefore denied to some new patient. This station is an advance base personnel depot, the majority of the patients come from personnel whose next duty will be overseas with a possibility of scant denture service, if any. Too often the dental officers have been consulted by distressed patients seeking satisfaction, or new dentures. In most of the latter cases rather than remake the dentures, which had been well constructed elsewhere, correction, by balancing the occlusion, was accomplished, resulting in great saving of time, more expeditious transfer of personnel and certainly a boost in morale and good will.

SUMMARY

1. Full denture prosthesis has progressively improved.
2. Two of the three basic requirements of satisfactory prosthesis, namely comfort and efficiency, depend upon the elimination of occlusal trauma. In truly balanced dentures occlusal trauma does not exist.
3. Balanced occlusion cannot be accurately judged visually, but requires scientific check by a precision instrument.
4. Equally distributed pressure by utilizing a central-bearing pin will fully seat the dentures and allow accurate recording of their true occlusal relationship.
5. Remounted in condylar registration, spot ground and milled to freedom of movement the dentures will provide occlusal balance with the many commonly known advantages.
6. Correction of unsatisfactory, nevertheless well constructed, dentures can frequently be accomplished by accurately balancing occlusion.

CLINICAL NOTES

UNDERWATER CONFINEMENT

REPORT OF THREE CASES

SEYMOUR L. ROMNEY
Lieutenant (MC) U. S. N. R.

The war has produced many harrowing experiences which have subjected men to extreme stresses. The arduous and hazardous aspects of underwater diving have been frequently emphasized and the need for careful selection of personnel recognized. Opportunities for extensive salvage, and other diving operations, may be anticipated as the war progresses, and in the postwar world. Continued vigilance in the selection of diving personnel must be observed if casualties in this field, fraught with danger, are to be kept minimal.

It is common knowledge that divers work in confined spaces; that the terrain may be uncertain; and oftentimes, they have been trapped in 10 or more feet of mud. The cases which form the clinical material of this report were observed during rescue operations following a diving accident which occurred in the course of salvaging sunken craft, lying in a local channel. A survey of diving records, literature, and interested personnel indicates that men have been known to have been trapped below for periods of 16 and 36 hours. This report is noteworthy in view of the successful rescue of one of our cases after being helplessly pinned in mud for 73 hours at an estimated depth of 55 feet.

CASE REPORTS

CASE 1.—History: A qualified deep sea diver, age 26 years, was working beneath a sunken LST on 16 February. Dressed in regulation diving gear, he had left the surface at 1300 and uneventfully completed a 40-foot dive to the bottom. He was utilizing a compressed air jet hose and was tunneling beneath the hull through the mud, in order to pass a cable to a colleague who was working in from the opposite side. Both divers reported excellent progress and preparations were made to complete the task. Suddenly, the excavation collapsed. Mud and hull wreckage bore down on the patient and incarcerated him within his diving suit and helmet. It was apparent that all muscular effort was futile and he notified "topside" at 1315 that he was stuck. Visibility was nil; his air

supply was intact and adequate. He anticipated prompt extrication and a resumption of his work.

Rescue operations continued for 3 days and 3 nights and were complicated by the presence of several large metal plates, debris from the sunken wreckage above, and the further entrapment of two others divers. Throughout, the patient retained a clear sensorium and remained calm and cooperative. A regulation $\frac{3}{8}$ -inch diver's hose supplied an adequate air supply, and in the last analysis proved to be the difference between life and death. Telephonic communication was maintained satisfactorily with standard equipment. The patient was encouraged to rest frequently and he succeeded in dozing periodically. He would awake with a start and anxiously await reassurance that rescue efforts were proceeding according to plan. The telephone was of inestimable value. The diver's spirited courage was a source of inspiration to those working above. The known physical hardships of his predicament—no food or water for 3 days; complete immobilization in mud; a cold, dark and damp environment; and the necessity to urinate in his diving suit—were dwarfed by the psychic implications of his helplessness. On 19 February at 1410, a fellow diver succeeded in freeing and bringing the patient to the surface. The diving helmet, breast plate, and weighted belt were quickly removed and the patient taken immediately by small boat to the recompression chamber of a rescue vessel which stood by. Five minutes elapsed between surfacing and arrival in the chamber. The diving suit was cut from the patient, shoes were removed, and examination performed in the chamber while recompression was begun.

Examination: Physical examination revealed an alert, calm, cooperative individual who appeared tired and physically exhausted. His subjective complaints were thirst, hunger, urinary urgency, uncleanness, and fatigue, and he enumerated them in that order. He had none of the symptoms or signs of compressed air illness. He had a mild purulent conjunctivitis; a persistent tachycardia with apical rate equal to pulse rate equal to 122; a blood pressure of 132 systolic, 84 diastolic; a palpable nontender sigmoid loop; and several scattered bruised areas overlying both shoulders, the right superior iliac crest, and the anterior aspect of the left knee. None of the latter seemed of any consequence. He had no cardiac enlargement or audible murmurs; his lungs appeared resonant to percussion and vesicular breath sounds were heard throughout. Abdominal viscera were not palpable. Neurologic examination was normal. All cranial nerves were intact and no pathologic reflexes were elicited.

Treatment: Recompression to 100 feet was completed and maintained for 30 minutes. During descent in the one-lock chamber, the patient was asymptomatic and a repeat neurologic examination was again negative. He was made comfortable with a crude sponge bath, succeeded in urinating spontaneously, and took sips of water in the interim. Decompression to 40 feet was accomplished without incident. This level was held for 15 minutes. Oxygen inhalation was started and administered for 1 hour, while ascent was made to 30 feet. A 12-hour "soak" followed at this depth. In this interval, superficial skin wounds were cleansed and dressed with 5-percent sulfathiazole ointment; the patient received 500 cc. of plasma intravenously and his first meal, consisting of chicken broth, crackers and several spoonfuls of oatmeal. He dozed intermittently and continued to awake, startled and thinking he was still trapped. Decompression, thereafter, was routine and without mishap. The patient was expectantly observed in the chamber for 6 hours on the surface, and then transferred to a naval hospital for convalescent observation.

CASE 2.—History: A qualified deep sea diver, age 24 years, was engaged in the same salvage operation as that described in Case 1. He had left the surface

at 1315 on 16 February and was tunneling beneath the sunken vessel. He expected to meet the diver who was working on the opposite side. When the "cave-in" occurred, he was thrown off balance and immobilized in the mud in a horizontal position. A large metal plate pressed against his anterior thorax. He struggled futilely to change his position. His efforts, and the efforts of those above to free him, were of no avail. He became excited and progressively more frantic. Attempts to reassure and calm him via the telephone did not succeed. He exhausted himself trying to move a limb, change his position, and free himself. Respirations heard over the 'phone, were rapid, grunting, and labored. At 1130 on 17 February, he was disoriented and irrational, and at 1225 telephonic contact was lost. Respirations were no longer audible.

At 1640 on 19 February, approximately 75 hours after leaving the surface and some 28 hours after communication ceased, the patient was brought to the surface. His diving suit and helmet were intact and air-containing. His control valve was open and an adequate air supply was present. Examination after diving gear had been removed, revealed evidence of rigor mortis and some putrefactive changes.

Autopsy findings:

Inspection: The body is that of a very well-developed white male. There is some maceration and desquamation of the skin over the chest, abdomen, and back and this is particularly marked on the right leg and foot which are swollen and discolored. Advanced putrefactive changes have occurred and there is marked gas production in all of the soft tissues. The skin of both arms, forearms, and left leg and foot is fairly well preserved. There is some collapse of the eyeballs.

Abdomen:

There is no increase of fluid in the peritoneal cavity and aside from post-mortem discoloration, the contents of this cavity are essentially normal. The abdominal cavity is moderately distended with gas in which there is an appreciable content of hydrogen sulfide.

Gastro-intestinal tract:

There is gaseous distension of the intestine, particularly the large bowel.

Liver:

Weight 1,060 grams. There is marked discoloration and softening representing post-mortem changes. The gallbladder and bile ducts are essentially normal.

Pancreas:

Marked post-mortem autolysis.

Spleen:

Weight 175 grams. There is moderate engorgement.

Adrenals:

Normal.

Urogenital tract:

Each kidney weighs 150 grams. Aside from post-mortem degenerative changes of the renal parenchyma, the kidneys, ureters, bladder, and external genitalia are normal.

Thorax:

In each pleural cavity there is a small amount of bloody fluid. There are moderately dense old pleural adhesions on the left side and more extensive fibrous adhesions in the right pleural cavity. The mediastinal structures are normal. A fair amount of thymus tissue is present.

Lungs:

The left lung weighs 600 grams and the right lung 740 grams. At the left apex there is a small amount of normally aerated lung tissue. The lower half of the left upper lobe and the entire left lower lobe are markedly congested and show very little possibility of aeration. The volume of the left lung is decreased and its consistency firm. The right lung contains even less aerated tissue than the left lung and congestion of all lobes is extreme. Bloody fluid is present in the trachea and bronchi and there is post-mortem discoloration of the mucosa.

Heart:

The pericardium is normal. The heart weighs 340 grams. The right ventricle and auricle are dilated. There is softening of the myocardium throughout, apparently due to post-mortem changes. The aorta, coronary arteries, endocardium, valves, and epicardium are normal.

Cranial cavity:

The brain weighs 1,500 grams. The consistency of the brain is soft throughout. The meninges are essentially normal. Microscopic examination of the brain as well as of other organs would be rendered unreliable and practically worthless due to extensive post-mortem autolysis.

CASE 3.—History: A qualified deep sea diver, age 36 years, voluntarily descended to the bottom during rescue efforts to free the trapped divers previously reported. He found the terrain muddy and treacherous and reported that the metallic debris from the wreckage complicated working conditions and made the going difficult. He succeeded in tracing the air line of one of the trapped divers to the large metallic plate which overlay the victim, and was backing out of the tunnel to obtain additional equipment when another "cave-in" occurred. Fortunately, he remained calm and cooperative during his confinement, despite a metal plate which lay across his left thigh. After much labor, he appeared to be free but for the fact that his air line was fouled in the sunken wreck situated above which prevented his ascent. It was decided to run a new air line and effect a change below. This change was completed without mishap in 4 minutes and the diver brought to the surface. He had been trapped at a depth of 45 feet for 17 hours.

Examination: Physical examination was conducted within the recompression chamber. The patient appeared cooperative and tired, but in no distress. His outstanding complaint was thirst, and he had some "soreness" involving the muscles of the left thigh. Significant findings on examination included an apical rate equal to pulse rate equal to 110; a 5 to 6 cm. hematoma and abrasion situated on the anterior medial aspect of the left thigh some 10 cm. from the anterior superior iliac spine (the site where the metal plate had been); a localized weakness of the left quadriceps and an absent left knee jerk. Cardiac examination was otherwise negative. Blood pressure was 124/80. His lungs were clear to percussion and auscultation.

Treatment: A modified type of surface decompression was employed because of the one-lock chamber, in anticipation that the divers still trapped below at a deeper depth might be momentarily brought to the surface. The patient was recompressed to 45 feet and kept there for 15 minutes. He was then "soaked" at 30 feet for 6½ hours, and run out to the surface with 60-minute stops at 20 and 10 feet. The medical locker was effectively used during the decompression time. Hot coffee, sandwiches, and magazines were passed into the chamber and the patient made comfortable.

On surfacing, the patient complained of residual muscle soreness of the left quadriceps and local tenderness was demonstrated. Over a period of days he felt much improved, though when extending the left thigh, he stated that he had the sensation that the metal plate was still bearing down. Two weeks later, he was asymptomatic.

COMMENT

Interest in underwater diving accidents has been focused on compressed air illness, aero-embolism, and diver's "squeeze." With extensive salvage operation, in many instances conducted in comparatively shallow depths but made hazardous by mud and wreckage debris and involving long periods of submergence, the possibility of entrapment is real. A preconceived therapeutic regime for this entity is worthwhile and contributes much to minimizing confusion which is apt to occur at a critical moment of rescue.

In view of the prolonged submergence, attention was initially directed towards possible physiologic disturbances related to the altered gaseous equilibria, incident to the increased pressure environment. Complete nitrogen saturation of fat and tissue fluids in the cases described above was assumed. In both of the successfully rescued individuals, the one at 55 feet and the other at 45 feet, despite periods of submergence of 73 and 17 hours, respectively, none of the symptoms or signs of compressed air illness or aero-embolism were observed. It was considered safer in Case 1 to treat the individual as a casualty and to complete the 100-foot decompression treatment, supplemented by an overnight "soak." Oxygen inhalation was administered upon arrival at 40 feet and continued at 30 feet for a period of 1 hour. This was undertaken with the thought that nitrogen desaturation would be accelerated with a decreased partial pressure gradient. It seemed unlikely that further hemoglobin and plasma re-oxygenation would occur at this depth and pressure. Oxygen saturation presumably had resulted during the long "pressure-breathing" siege. Case 3 was recompressed to 45 feet for 15 minutes and then desaturated at 30 feet for 6½ hours. Rapid surfacing could have been effected without delay or risk to the patient during this time, and this expedient might have been necessary in view of the one-lock chamber. During this decompression, the still trapped divers were momentarily anticipated. Thus, potential disturbances inherent in underwater diving were treated prophylactically.

General supportive therapy was actually of prime importance. Plasma was given as an antishock measure because of the physically exhausting experience and the knowledge of the associated emotional and psychological trauma. It was supplemented by warm broth and porridge orally. Body cleansing efforts in the chamber and attention

to bowel and bladder hygiene were most appreciated by the patients. When the individuals left the chamber, they felt reasonably well and had succeeded in sublimating the details of the harrowing experience.

Was the fatality encountered in this accident a case of an individual being "scared to death"? It is generally agreed that fright of sufficient intensity and of sudden, abrupt presentation, can produce collapse. There can be little question of the degree of psychic trauma involved in prolonged, helpless confinement below the surface. Any degree of claustrophobia or nyctophobia impairs the efficiency of the deep sea diver, and is therefore a disqualifying mental defect. However, even the most stable individual without any latent phobias, could be expected to succumb to an anxiety state when confronted with such trying circumstances.

The outstanding finding at autopsy was acute extreme pulmonary congestion. The lungs contained little tissue which looked capable of aeration. A constant air supply had been maintained throughout the rescue operation, and the air compressors were keyed for maximum output. The diving suit was intact and aerated when examined on the surface. Drowning was not compatible as the cause of death. It seemed reasonable to presume that asphyxiation due to the accumulation of carbon dioxide had occurred. The diver struggled continuously, his respirations were heard over the 'phone to be dyspneic and hyperpneic and the concentration of carbon dioxide in the circulating air in his helmet could conceivably have been toxic. Microscopic examination of the brain was not undertaken due to extensive post-mortem autolysis.

SUMMARY AND CONCLUSIONS

1. Three cases of prolonged underwater confinement are presented. Rescue was accomplished in two of them.
2. One of the survivors had been submerged at a depth of 55 feet for a period of 73 hours. He was in amazingly good condition.
3. Physiologic alterations related to the increased pressure environment were not encountered. None of the signs or symptoms of compressed air illness or aeroembolism were observed.
4. The outstanding finding at autopsy in the fatality was acute, extreme pulmonary congestion.
5. The arduous and hazardous aspects of underwater diving are real. Continued care in the selection of diving personnel must be stressed.



MASSIVE FAT EMBOLISM FOLLOWING FRACTURE OF THE FEMUR

REPORT OF FOUR FATAL CASES WITH NECROPSY FINDINGS

EVERETT M. GEORGE

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and

JOHN E. BLUMGREN

Lieutenant (MC) U. S. N. R.

During a 46-day period at a United States naval fleet hospital in the Central Pacific area, there were 4,607 admissions. Of this number, 30 patients were admitted with the diagnosis of fracture, compound, femur, and 8 patients with the diagnosis of fracture, simple, femur. There were 5 fatalities in this group of 38 patients. One patient died following an overwhelming gas-bacillus infection which was unchecked despite disarticulation at the hip of the right lower extremity immediately following admission. In the remaining 4 fatal cases the clinical pictures were remarkably similar from the time of admission of the patients to their death. It is these cases we wish to discuss. Post-mortem examination revealed that each of the 5 patients died because of massive fat embolism following compound fracture of the femur.

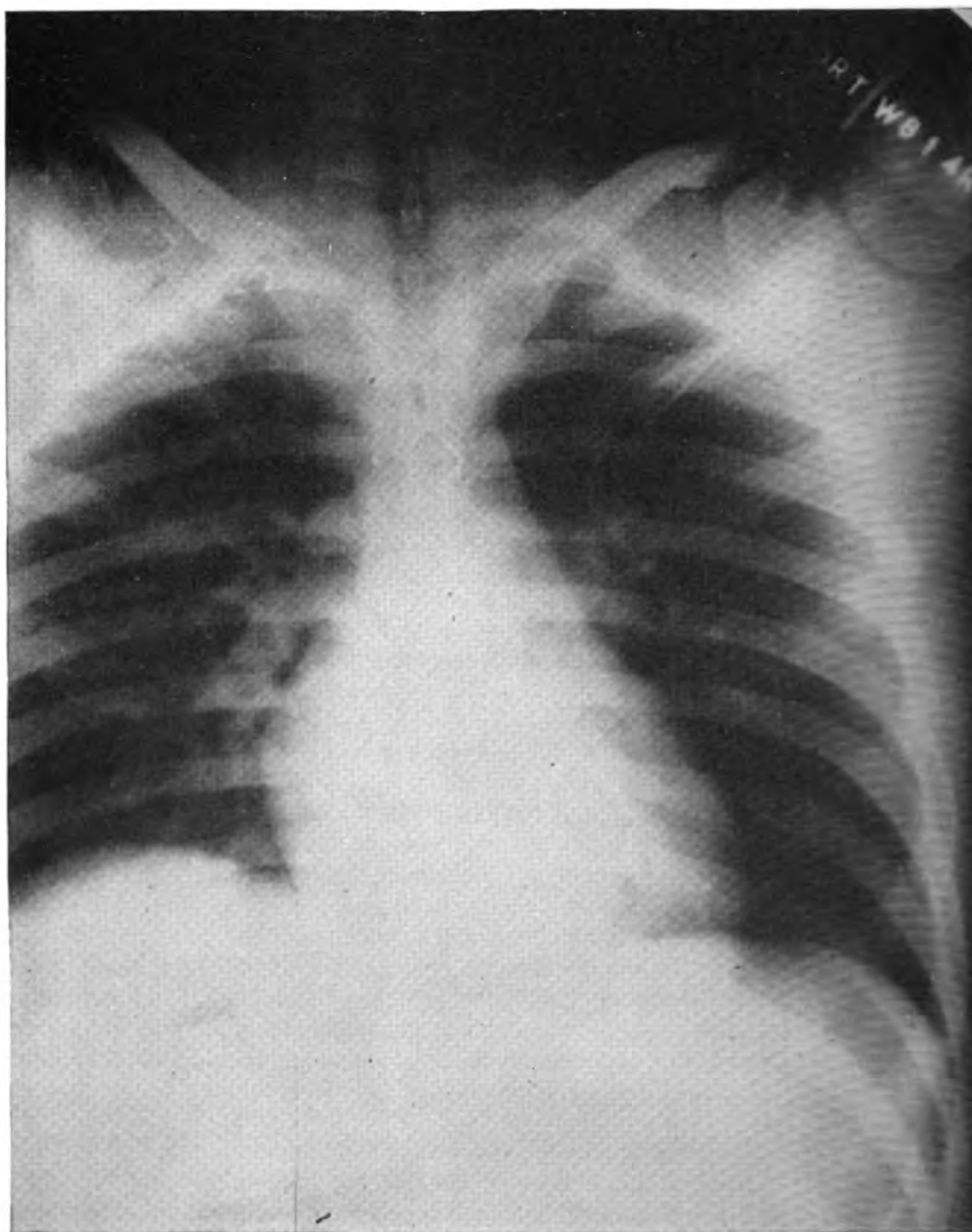
CASE REPORTS

Case 1.—A seaman, second class, 19 years of age, was crushed between two trucks, following which he was unable to stand, and complained of pain in both thighs. The accident occurred 10 miles from the hospital, necessitating a trip by "jeep" over rough roads. No traction splint was applied to either extremity. He was admitted in a state of shock. Deformity and shortening of both thighs indicated fracture of both femurs. Shock therapy was administered immediately and bilateral Russell traction with adhesive was applied.

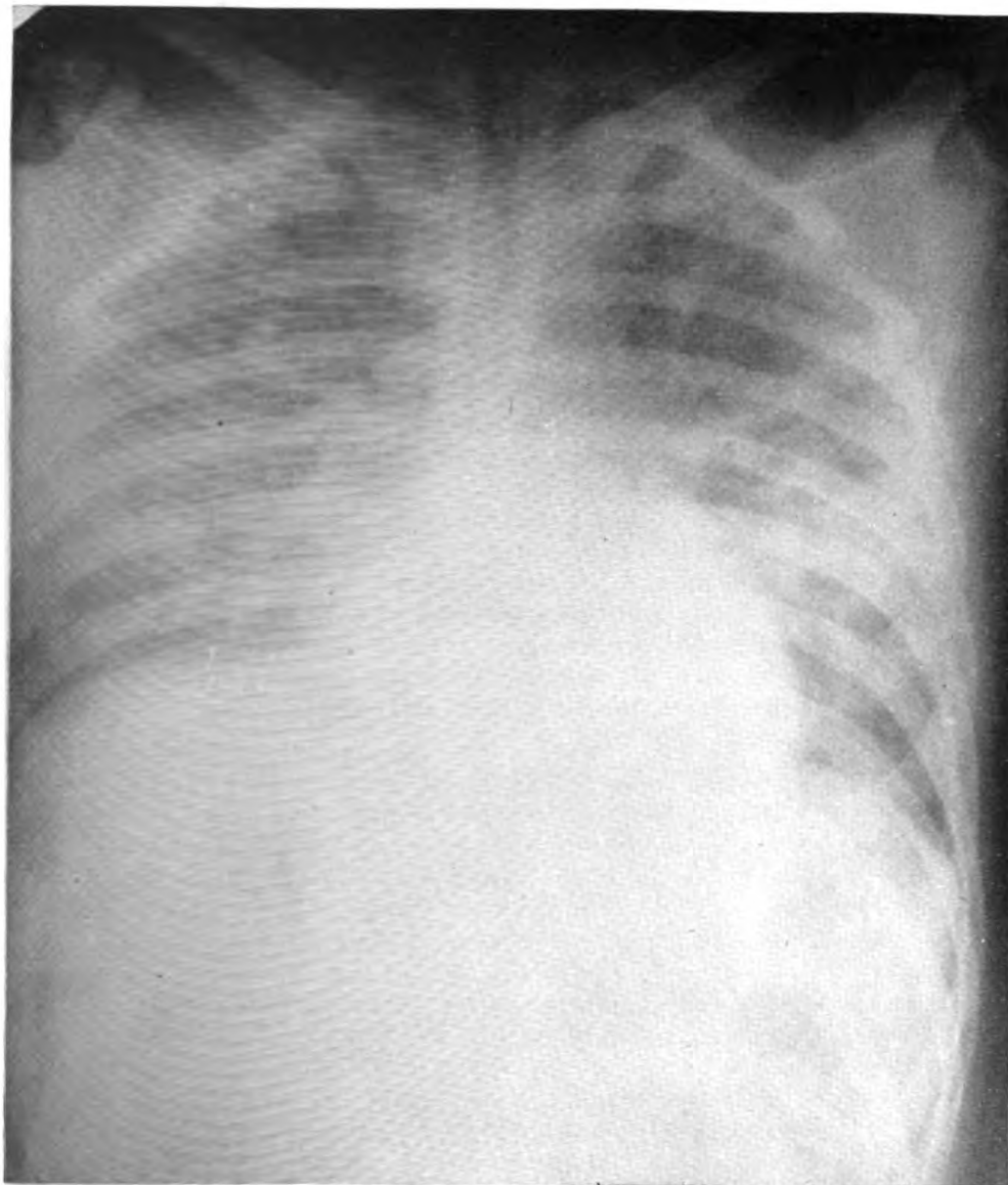
On the second day the patient developed a chill and his temperature rose to 103° F. A few subcrepitant râles were audible at the base of the right lung. X-ray examination of the chest (fig. 1) revealed normal findings. That evening he suddenly became hyperpneic and had a mild clonic convulsion of both upper extremities. The fists were tightly clenched. Abdominal reflexes were absent. There were no localizing cerebral signs. A presumptive diagnosis of massive fat embolism was made. Because of cyanosis, oxygen administration by nasal catheter was instituted. His temperature at this time was 100.6° F. Cyanosis persisted on the third day and oxygen therapy was continued. On the fourth day he became irrational and disoriented, and the temperature again rose to 103° F.

On the fifth hospital day he developed frequent paroxysmal bouts of coughing, and his condition became immediately grave. X-ray examination of the chest (fig. 2) revealed a bizarre mottled density throughout both lung fields suggestive of small scattered areas of bronchopneumonia and pulmonary edema. This could be ascribed to numerous small infarctions as the result of emboli. His respiratory difficulty increased and he expired that evening.

Necropsy.—In addition to the bilateral fracture of the femur, necropsy revealed evidence of beginning bronchopneumonia of the hilar regions, and extensive hyperemia and edema of the lungs. Many small petechia-like areas of hemorrhagic infiltration were noted in the visceral pericardium and along the mediastinal pleura. The liver, spleen, and kidneys were somewhat congested and the brain was very edematous. Microscopic studies of the lungs revealed hyperemia, congestion, and a fairly uniform distribution of fat in the small arteries and capillaries. The brain was not studied for the presence of fat, but paraffin sections showed many small ring-like hemorrhages typical of fat embolism.



1. Roentgenograph, chest (Case 1), second day.



2. Roentgenograph, chest (Case 1), fifth day.

Case 2.—A Marine private, 25 years of age, was wounded by shell fragments and sustained a compound fracture of the lower third of the right femur with extensive tissue damage, flesh wounds of the left lower leg, and a large gaping flesh wound of the left heel. He was treated in the field under pentothal anesthesia, with radical debridement and cleansing of the flesh wounds, application of sulfanilamide powder, and vaselin-gauze dressings and a Thomas traction splint, and administration of whole blood and 5 cubic centimeters of combined gas-gangrene antitoxin and 50,000 units of penicillin.

He was evacuated by air and admitted to this activity approximately 24 hours later, at which time the right lower leg and foot were found to be blue and cold. After dividing all constricting bandages, there was no return of color or warmth.

Ice packs were applied and he was given whole blood and 5-percent dextrose and saline solution. Two days later the right foot was gangrenous. A guillotine amputation was performed at the middle third of the right femur without other tourniquet than digital pressure by the hospital corpsman over the femoral artery pressure point at the groin. Extensive comminution was encountered at the site of fracture. The stump was dressed with sulfanilamide powder and vaselin gauze, and skin traction straps were incorporated in the dressing.

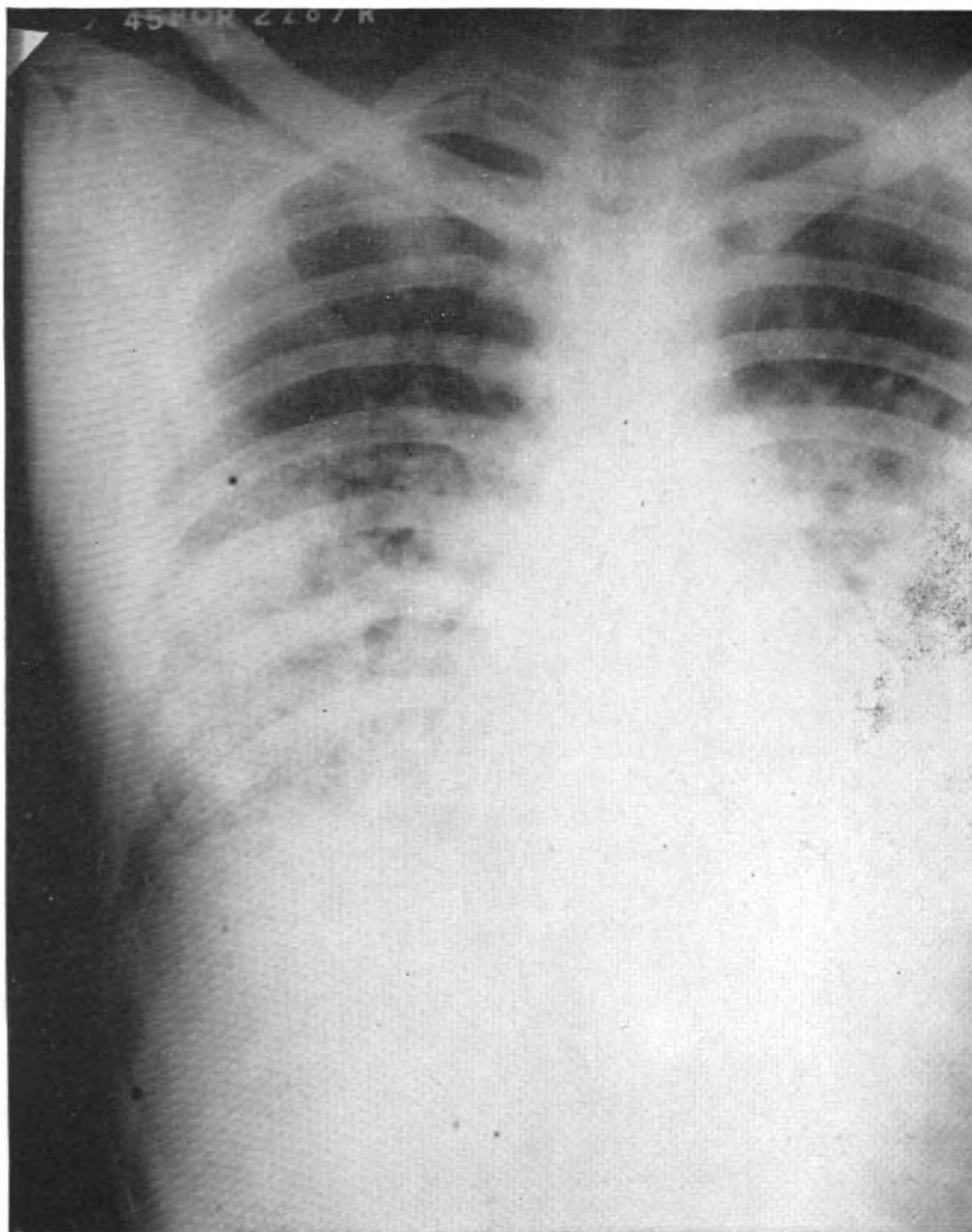
Convalescence was uneventful until the eighth day, when the patient complained of pain and swelling in the stump. Inspection revealed no evidence of any local pathology, and local heat and sedatives afforded relief. During the night he suddenly called out, gasping for breath. He was found to be cold, cyanotic, and pulseless. He was restless, disoriented and irrational. Caffeine and sodiumbenzoate was given at once, oxygen by face mask was begun, and intravenous administration of fluid attempted. He expired very quickly. The impression was that the cause of death was pulmonary embolism.

Necropsy.—The amputation stump was in good condition. The right side of the heart was filled with a massive postmortem clot which appeared to contain a considerable amount of fat. There were a few petechial hemorrhagic areas under the visceral pericardium. The lungs were firm, and on cut section revealed extensive congestion and the appearance of many fatty globules which apparently came from the severed small arteries and lung substance. The brain was not examined. Microscopic studies of the lungs revealed many small arteries, capillaries, and alveoli to be filled with fat.

Case 3.—A fireman, first class, 18 years of age, was whipped off the deck of his ship during an engagement when a 5-inch steel cable parted. He was thrown about 40 feet from the ship into the water and was able to stay afloat with difficulty by grasping life preservers thrown to him. He was transported by small craft to a field hospital in the combat area, where it was found that he had sustained a comminuted fracture of the right femur, middle third, and lacerations of the perineum. After administration of blood plasma, a right plaster spica cast was applied.

He was evacuated to this activity by air approximately 36 hours after his injury. On admission his temperature was 101° F. There were no unusual clinical symptoms on admission. On the following day, however, he complained of difficulty in breathing. The respiratory rate was 30 and the blood pressure 140/55. Fine, persistent, moist râles were heard over both the left and right sides of the chest anteriorly. The patient was cyanotic. X-ray examination of the chest (fig. 3) revealed that both lung fields were almost completely obscured in the lower portions by patchy areas of increased density, resembling bronchopneumonia. The consolidation appeared to be most pronounced in the lower hilar regions. The presumptive diagnosis was massive fat embolism and co-existing bronchopneumonia. Treatment consisted of oxygen by nasal catheter and penicillin, 15,000 units every 3 hours, whole blood, blood plasma, and dextrose in saline solution. The condition progressed unfavorably, the patient becoming semiconscious, with increasing respiratory difficulty, and he expired the following day, 4 days after admission.

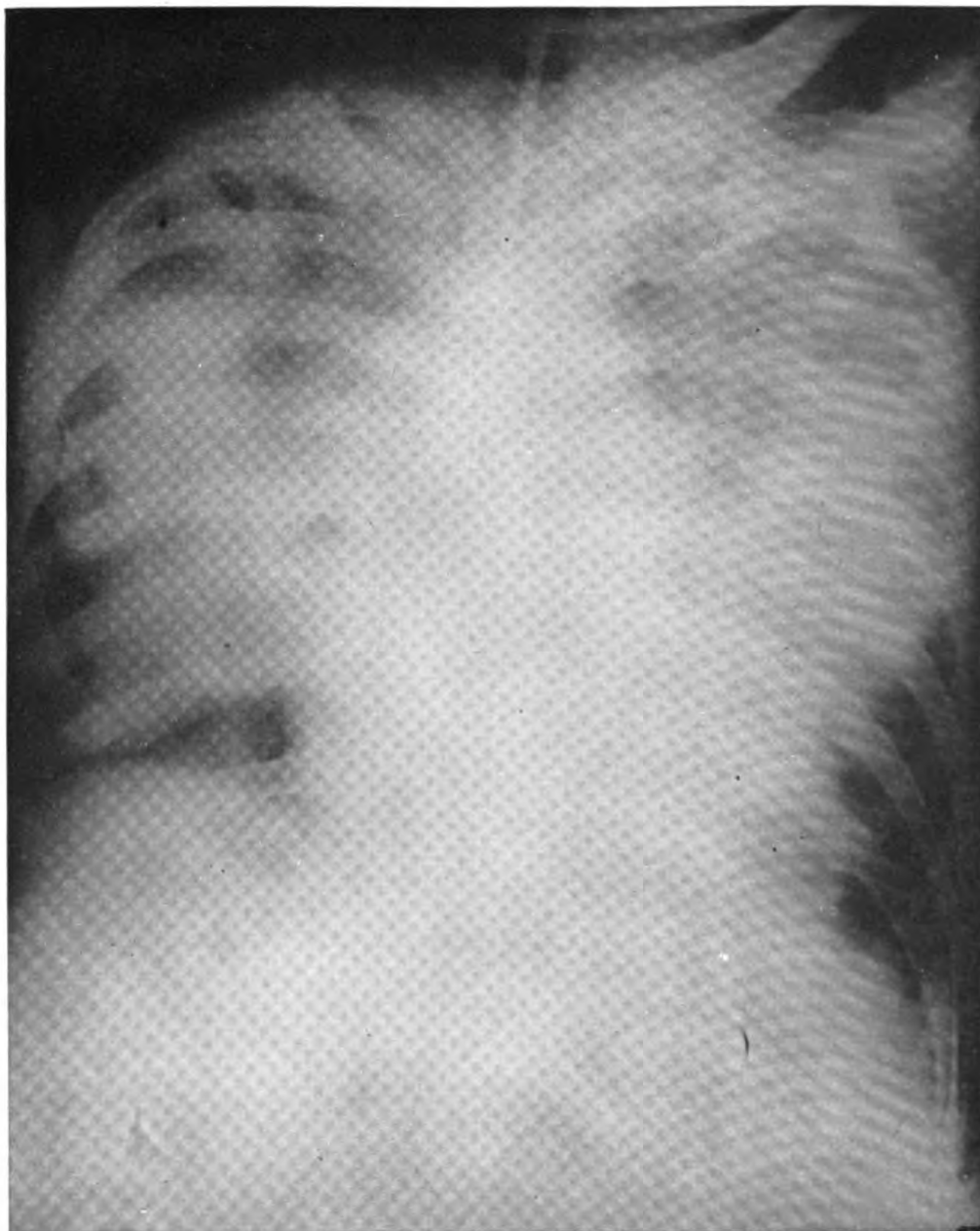
Necropsy.—In addition to the previously mentioned findings, examination revealed the lungs to be firm throughout, and on cut section they were found to be extremely hyperemic and edematous, with scattered areas of changes consistent with beginning bronchopneumonia in the lower lobes. The brain was mildly congested and edematous. Microscopic sections revealed fat to be quite uniformly distributed in the small arteries, capillaries, and occasionally in the alve-



3. Roentgenograph, chest (Case 3), third day.

oli. The brain was edematous and showed numerous areas of ring-like hemorrhagic infiltration.

Case 4.—An Army private first class, 35 years of age, a moderately obese Negro, was injured in action by multiple shell fragments, sustaining a compound fracture of the left femur and compound fractures of the lower right radius and small bones of the hand. The following treatment was given in the field the next day: Debridement of all wounds, application of a plaster cast to the right forearm and hand, and another cast, incorporating a Thomas traction splint, to the left leg. His condition was so critical that evacuation by air was not attempted for 2 days.



4. Roentgenograph, chest (Case 4), ninth day.

He was admitted to this activity on the third day after injury, still seriously ill. The temperature was 101° F., pulse rate 120, and respirations 24 per minute. He had a persistent hiccough. The abdomen was distended, but intra-abdominal injury had not occurred. A few moist râles were heard at the bases of both lungs. On the fifth day after injury the cast to the left leg was removed under pentothal anesthesia. It was ascertained that there was a "supracondylar Y" compound comminuted fracture of the left femur. This was reduced and a long leg spica was applied.

Hiccough persisted and in addition there was vomiting of greenish fluid. Carbon dioxide and scopolamine were administered, and Wangensteen drainage was

instituted with some apparent relief and general improvement for 4 days. Penicillin and sulfadiazine were continued. The next day, however, 9 days after injury, he suddenly became confused, disoriented, restless, and was gasping for breath. The pulse rate was 130 and respirations were 40 per minute. X-ray examination of the chest (fig. 4) revealed that both lung fields were almost totally obscured by a mottled density more prominent in the midportion of either lung, and in the region of the right and left hila. These findings suggested a widespread pulmonary edema with consolidation of both lungs, the distribution of which was suggestive of embolism. The presumptive diagnosis was massive fat embolism with pulmonary and cerebral involvement. The patient expired early the same evening.

Necropsy.—In addition to the fractures, examination revealed obliterating fibrous pleurisy and uniform hyperemia and congestion of the lungs, with scattered areas suggestive of bronchopneumonia, especially in the lower lobes. The right side of the heart was engorged and somewhat enlarged, and the liver, spleen and kidneys were mildly congested. Section of the lungs revealed fat deposits in the small arteries and capillaries. Sections were not obtained of the brain.

COMMENT

In all four cases there were similar autopsy findings, with filling of the small arteries and capillaries of the lungs with fat. Two of them revealed ring-like hemorrhages of the brain, and one had fairly definite evidence of enlargement of the right side of the heart. A more detailed study of the tissues was not attempted because of limited facilities and difficulty in making the proper stained sections.

The method of study of fat in the lungs, although not new, illustrates what may be accomplished with minimal supplies and equipment. Because of the lack of a freezing microtome and osmic acid, we resorted to packing the specimens of tissue in ice and cutting the frozen tissues with a razor blade. These sections were then stained with Sudan III and were found satisfactory for the study of pathologic fat deposits and establishment of the diagnosis.

As presented by most standard textbooks, and in our own experience, massive fat embolism following fracture of the long bones has been an acknowledged clinical entity for many years. It is also established that fracture of a long bone is not an essential factor, as fat embolism has followed soft-tissue damage alone. Surgical operations, especially on obese persons with excessive subcutaneous fat, interosseus fat, and fatty viscera have been known to result in fat embolism. This condition has also followed osteomyelitis and has been noted after skeletal jarring injuries.

The chief source of fat is the bone marrow, and this fat more readily liquefies because it has a lower melting point than subcutaneous fat. This mobilized fat is carried through the venous system to the heart and lungs where, in the latter, many small arteries and capillaries are

filled, and circulation through them is blocked. The lung, however, is not an absolute filter, and a considerable quantity enters the general circulation and lodges elsewhere, especially in the brain and kidneys, and on occasion has been found in the liver, spleen, and pancreas.

The reaction to fat embolism is quantitative. The fat may be absorbed from the vessels, having produced little or no disturbance. In cases of fracture of the long bones when death has been due to other causes, it is not rare to find a few fat droplets in the lung tissue with no sign that such small fat embolism was of any clinical importance. However if fat is of an amount sufficient to produce mechanical resistance to pulmonary circulation by virtue of the fat droplets in the smaller vessels, there is an associated rise in pulmonary arterial and right intraventricular pressure, accompanied by a fall in systemic arterial pressure and a rise in systemic venous pressure.

The exact amount of fat required to be fatal in the human is not known. The shock following an injury, with resulting fall of blood pressure, may cause otherwise insignificant amounts of fat in the pulmonary circulation to become of grave significance. The question arises whether it is possible that tropical heat may enhance the liquefaction and mobilization of fat to augment massive fat embolism,

These four patients had these several factors in common: (1) fracture of the femur with considerable associated shock; (2) frequent handling and excessive transportation as demanded for rapid evacuation of war casualties; (3) the first clinical symptoms were those of dyspnea, cyanosis, restlessness, and apprehension; moist râles and signs of pulmonary edema coincided; (4) terminal clinical signs indicated cerebral involvement with disorientation and coma; and (5) similar necropsy findings, with globules of fat present in the small arteries and capillaries of the lungs.

No therapeutic agent has been advanced which has proved completely satisfactory in the treatment of this condition. Once the cerebral manifestations were evident, death of our four patients resulted within 48 hours. It must be emphasized that proper immobilization of the fracture, and care in handling and transportation of patients suffering from fracture of the femur, especially in the Tropics, is important if fatal complications such as these are to be prevented. It is hoped that further studies of massive fat embolism may be carried out to add to this report.

SUMMARY

1. Four fatalities due to massive fat embolism following compound fracture of the femur are presented.

2. Positive diagnosis by microscopic findings was made following necropsy in each case.

3. Proper immobilization and care in the handling and transportation of patients with fracture of the femur are emphasized.



DANGER OF FINGER RINGS

CHARLES M. THOMPSON

Lieutenant (MC) U. S. N. R.

Since the opening of this naval dispensary approximately 18 months ago it has forcibly been brought to the attention of the medical staff that finger rings are a dangerous hazard to all personnel, both naval and civilian. There have been several amputations and many moderate to severe injuries to the soft tissues. The loss of man-hours has been considerable for this naval activity, to say nothing of the pain and suffering inflicted upon the persons involved. In spite of suggestions and memoranda cautioning of the dangers of wearing finger rings these accidents still happen with seemingly increasing frequency.

Most injuries occur as the person descends or jumps from a height, as the following case reports show. The ring catches on a protruding nail head or other object and neatly strips the soft tissues from the bone and often fractures it. Complete evulsion of the entire finger has occurred in some cases, while in others the tissues were cut, necessitating tendon and skin repair.

The following case summaries and accompanying photographs are illustrative of this injury.

CASE REPORTS

Case 1.—When attempting to jump from a truck, the patient caught the ring on the fourth finger of his left hand on some protruding object. The skin and subcutaneous tissues completely encircling his finger were lacerated down to the bone and evulsed partially toward the tip of the finger. The ring was still on the finger when admitted and had to be cut off. The part involved was blue, cyanotic, and rather cool, suggesting possible destruction of the blood supply. An attempt was made, however, to approximate the tendons and soft tissues, but 2 days postoperatively the finger was gangrenous distal to the laceration with no apparent circulation. Amputation at the metacarpophalangeal joint was done without complication, and the patient discharged to duty 23 days after injury.

Case 2.—The patient jumped from a torpedo tube to the deck catching his ring on part of the tube and pulling the skin off his finger. There was complete

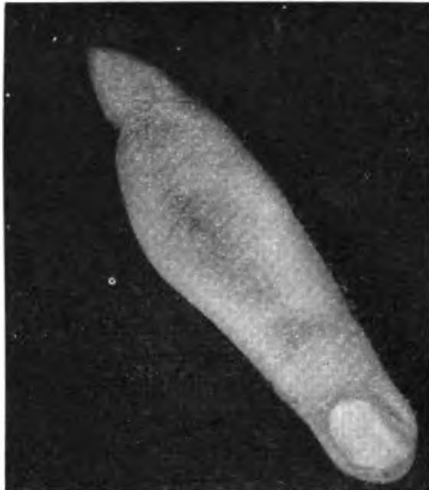


FIGURE 1.

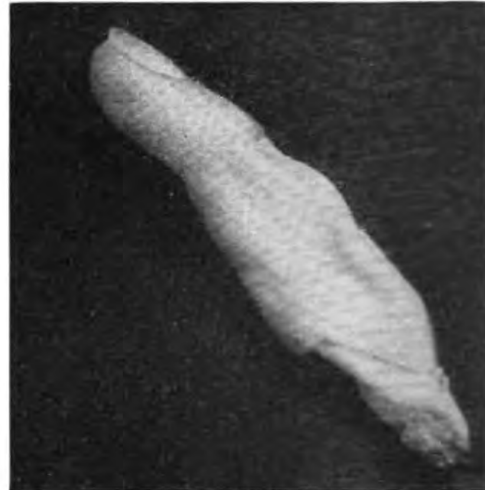


FIGURE 2.

(Case 4). The photographs reveal how neatly the ring amputated the soft tissues and the terminal phalanx. The indentation caused by the ring is readily seen at the base of the finger.

evulsion of the soft tissues and exposure of bone. The second phalanx was fractured and the ring was still caught in the tissues. Amputation was performed at the metacarpophalangeal joint and the patient was discharged to duty 16 days later.

Case 3.—While jumping down from a truck that was transporting him to work, the ring on his right hand of a 45-year-old civilian caught on a hook of the tailgate of the truck.

There was complete removal of all the soft tissue over the middle and distal phalanges with the bone entirely exposed. Amputation was performed through the neck of the proximal phalanx. The stump of the finger was very slow in healing and the patient was absent from work for approximately 3 months.

Case 4.—While at work the patient slipped on a ladder catching his wedding ring on a screwhead completely amputating the soft tissues and the distal phalanx (figs. 1 and 2), leaving only bone and the deep tendons remaining. The remainder of finger was disarticulated at the metacarpophalangeal joint. The patient was discharged to duty 15 days later.

The dangers of wearing rings cannot be stressed enough. Injuries from them are unnecessary and entirely preventable, but rings will still be worn in spite of repeated warnings as to their dangers. Persons engaged in mechanical and other work where a hazard is involved should be informed of the danger and advised against wearing rings. An order prohibiting the wearing of rings would probably infringe on a man's personal rights and be difficult to strictly enforce, but it seems to be the only answer to this problem.



THE MARCUS-GUNN SYNDROME

REPORT OF A CASE

JAMES L. WELLS
Commander (MC) U. S. N.

R. Marcus Gunn first described, in 1883, the "Congenital Ptosis with Peculiar Associated Movements of the Affected Lid," a syndrome which now bears his name. Since then something over a hundred cases have been reported, one of which was in the U. S. Naval Medical Bulletin of April 1934 (5). This brief review of the syndrome is not presumed to be complete, but it is hoped that it will be of interest to other medical officers.

CASE REPORT

A male, age 25 years, was seen while processing enlisted men for overseas duty. He offered no complaints but was seen to have a ptosis of the left eyelid. On questioning he stated this condition had been present since infancy.

Personal history.—There was no history of birth injury or subsequent head injury. Progressive and normal development occurred during infancy and childhood. According to his parents, he always had a ptosis and associated winking of his left eyelid. During childhood he noted that on talking or eating his left ptosed eyelid would wink up and down. He has been able gradually to overcome the abnormal movements on talking, but they persist while eating, opening mouth wide, and on movement of the mandible to the opposite side. On questioning, patient states that no relative has any similar condition.

General physical examination was entirely normal except for the ptosis and abnormal movements of the left eyelid to be described.



FIGURE 1.

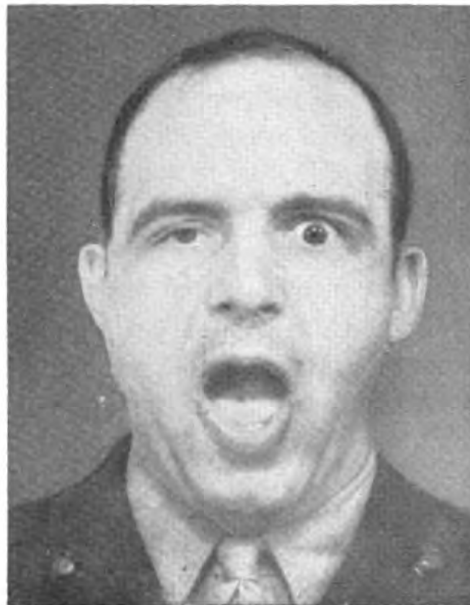


FIGURE 2.

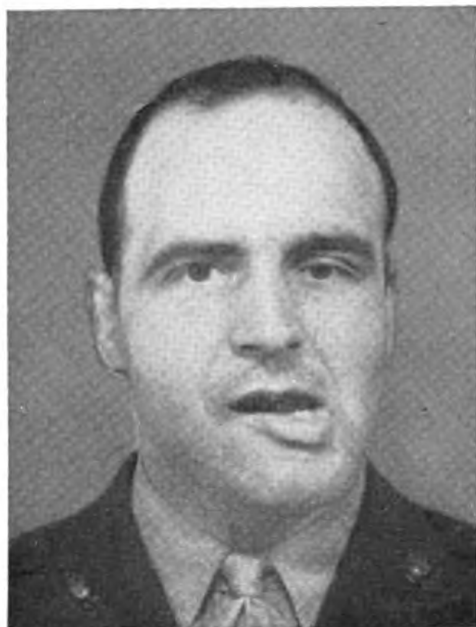


FIGURE 3.



FIGURE 4.

Neuromuscular examination.—Reflexes and sensations were normal. The pupils were equal and reacted normally to light and accommodation. Vision was 20/20 in each eye and with binocular vision. All extraocular movements were normal, and the corneal reflex was present. The facial muscles were normal and movement of these did not cause any abnormal movement of the eyelids.

The left eye showed a ptosis (fig. 1) which covered the upper one-fourth of the pupil. The left upper lid can be raised and follows ocular movements, but when compared to the right lid there was always a relative ptosis. When the mouth was opened wide (fig. 2) there occurred a marked uplifting of the left upper eyelid. On movement of the mandible to the right the lid again flies upward (fig. 4). When, however, the mandible is moved to the left, there is no change in the ptosis (fig. 3).

This case follows the majority of reported cases in that movement of the eyelid occurs on movement of the external pterygoid muscle of the same side.

DISCUSSION

This condition then consists of abnormal movements of the upper eyelid with movements of the jaw. It is not an hereditary condition; however, it is generally congenital, it being acquired in only about 5 percent of cases. In the reported cases, the error is about equally distributed between the two eyes and between the two sexes. There have been no cases of bilateral involvement reported. Generally, the condition is associated with a ptosis although this is not always true. Often there is an associated paresis of one or more of the the ocular muscles. Sinclair's four variations of the condition were: (1) Uni-

lateral ptosis in which the drooping lid raised on opening the mouth, and when the mandible moved toward the opposite side; (2) unilateral ptosis which is raised when the mouth is opened, but not when moved to the side; (3) unilateral ptosis which is raised when the mouth is moved to the opposite side, but not when opened, and (4) cases in which associated movements of the eyelid and lower jaw occur but there is no ptosis.

Many types of bizarre associated movements have been described. For instance, in the case of Frowaget and Brun, closing the opposite eye resulted in elevation of the ptosed eye. Blok reported a case in which puffing out the cheeks, as in whistling, elevated the ptosed lid.

Explanation.—Several principal explanations have been offered for this syndrome, but, since no autopsy findings have been reported, all are hypothetical. The theory first advocated by the committee studying Gunn's case and accepted by most observers is adequately summed up by Sym as follows: There does not appear to be any other probable explanation of this curious association than that, in some inexplicable way, there arises some confusion in the joining up of fibers and cells belonging to the fifth and third nuclei in such a fashion that the levator receives less than its normal innervation, and there is, therefore, a certain degree of ptosis, but without any paralysis of the muscle, which is capable of full contraction. At the same time the levator receives some fibers which are "intended for" one or more of the muscles of mastication, and when these muscles are put in action, at all events, when put strongly in action, the levator is unintentionally innervated, producing the curious effect described.

One of the recent explanations disagreeing with the above is that of Lewy, Groff, and Grant (3). They contested the above explanation because their case presented was cured of the associated movement by section of the motor root of the trigeminal nerve. The abnormal movement could still be reproduced by a passive forcible opening of the mouth, however. Their conclusion was that it was caused by some abnormal proprioceptive reflex arc. In their case, the abnormal movement was abolished by instillation of 1 percent homatropine into the eye. This, plus experimental evidence, led them to further conclude that the levator is elevated by the action of autonomic (the type uncertain) fibers to that muscle, a "pseudo-motor phenomenon." Here the question rests.

Treatment.—None is indicated unless the patient becomes so self-conscious as to cause nervous symptoms. One case was cured by Grant by sectioning the motor root of the trigeminal nerve.

SUMMARY

A case of Marcus-Gunn syndrome has been presented and the syndrome discussed briefly.

REFERENCES

1. GUNN, R. M.: Congenital ptosis with peculiar associated movements of eye: *Tr. Ophth. Soc. U. Kingdom* 3: 283, 1883.
2. GRANT, F. C.: Marcus Gunn phenomenon; report of case with suggestions as to relief. *Arch. Neurol. and Psychiat.* 35: 487-500, March 1936.
3. LEWY, F. H., GROFF, R. A., and GRANT, F. C.: Autonomic innervation of eyelids and Marcus Gunn phenomenon; experimental study. *Arch. Neurol. and Psychiat.* 37: 1289-1297, June 1937.
4. COOPER, E. L.: Jaw-winking phenomenon; report of case. *Arch. Ophth.* 18: 198-203, August 1937.
5. WILSON, G. C.: The Marcus Gunn Syndrome; report of a case. *U. S. Nav. M. Bull.* 32: 200, April 1934.
6. INGRAHAM, F. D., and CAMPBELL, J. B.: Marcus Gunn phenomenon. *Arch. Neurol. and Psychiat.* 46: 127-134, July 1941.



SECONDARY SYPHILIS OF THE TONSILS

BERNARD M. COHEN

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Three cases of secondary syphilis of the throat came to our attention during a relatively short period of time. These cases occurred at an advanced base at which location the majority of the personnel had been for many months without contact with the female world. The ease with which a diagnosis can be made even with limited laboratory facilities, dictates that all cases of prolonged atypical sore throat should be suspected. No attempt will be made to discuss syphilis from the point of view of pathology or treatment. The casual relationship between the primary lesion of syphilis and the appearance of throat symptoms as well as the average patient's lack of knowledge of his systemic infection, produce difficulty in diagnosis. Unless one is constantly on the alert and constantly bears in mind the possibility of syphilis, many errors in diagnosis will be made and many true secondaries overlooked. The large number of patients demonstrating tertiary syphilis of the vascular or nervous system or positive serology on routine laboratory workup who have no knowledge of primary or secondary lesions leads me to believe that the early manifestations of syphilis existed but were overlooked or misdiagnosed. Syphilis is a great imitator. The pharyngeal lesions are usually nondescript and

simulate many conditions which occur more commonly. Even a careful history may fail to reveal a pre-existing chancre and after the subsidence of the pharyngitis, tonsillitis, or laryngitis, the entire episode will be forgotten by both the patient and the physician. Early diagnosis means early treatment, so certainly this is to be desired.

The secondary stage appears in most instances 2 to 3 months following the initial infection although the characteristic laryngeal changes may appear 6 months to 3 years after the initial lesion. The mucous patch occurs on the mucous membrane of the lips, mouth, or throat a little before, or perhaps at the same time as the skin rash. These mucous patches take the form of erythematous or papular areas. The papules are grayish white, slightly elevated, smooth, oval or rounded plaques which stand out distinctly from the surrounding tissues. The erythematous areas are well demarcated although they may coalesce. They are of irregular shape. If these patches become hypertrophied, they assume a dirty yellow color and a rough surface. When subjected to mechanical irritation they tend to slough. The involved areas are almost always symmetrical, i. e., both sides of the throat are attacked in corresponding localities by similar lesions.

The tonsillar lesions that I have seen have not presented the typical picture of syphilis. The complaint of the patients was merely soreness of the throat on swallowing and in one instance persistent hoarseness. They had all been examined and treated repeatedly either by myself or other medical officers. The lesions had to be "looked for." Casual examination revealed nothing more than what could be described as a reddened pharynx. However, the persistence of symptoms despite routine pharyngeal treatment led to more careful examination. Very minor, pale, bluish-white, irregular, superficial translucent patches seen on the tonsil led to further diagnostic tests which easily determined the diagnosis. Most of these cases are diagnosed as and treated as Vincent's angina due to the Plaut-Vincent organisms. Smears of the areas may even show such organisms as secondary invaders. However, the characteristic superficial location of the lesions, their bluish-white appearance, the lack of actual thick membrane that usually accompanies Vincent's and their failure to respond to treatment should make one suspicious of the specificity of the etiology. The first patient of my series was treated by myself for Vincent's infection. Fortunately for him, the condition persisted long enough for me to become doubtful of my diagnosis. The second and third cases presented themselves shortly thereafter and the similarity of the local appearance led to early laboratory as well as clinical diagnosis.

In general, even in the absence of a history of chancre or other manifestations of secondary syphilis, the diagnosis should be considered

when the following are seen: Bilateral, irregular and superficial denudations or ulcerations over the presenting surfaces of the tonsils or pharynx, a thin, nonodorous, bluish-white translucent membrane. The presence of cervical or general lymphadenopathy or a coexistent laryngitis or generalized rash will help.

In passing, it will be well to mention the laryngeal manifestations of secondary syphilis. In my experience, the so-called typical metallic cough has not been seen (or heard). Hoarseness without pain has been the presenting symptom and the pharyngeal lesions seen only after careful examination. The laryngeal picture early may show papular lesions of the vocal cords, epiglottis, or aryepiglottic folds. They are distinctly elevated above the mucosa and have a marked tendency to coalesce. As is true in all laryngeal lesions, the use of the voice with resultant irritation of the larynx produces a diffuse laryngitis and a change in the laryngoscopic picture. Those that I have seen have shown merely a diffuse intensely red larynx with bilaterally symmetrical ulcerations and edematous mucosa. The picture has not been characteristic but the presence of pharyngeal lesions have dictated the probable diagnosis and the laboratory has proved it.

CASE REPORTS

Case 1.—A colored mess attendant was seen in June 1943 in the outpatient clinic. His complaint was that of sore throat of 2 weeks' duration. The patient was found to be afebrile, had a large irregular patchy ulceromembranous lesion on each tonsil. The pharyngeal mucosa, soft palate and buccal mucous membrane showed a peculiar bluish-white appearance resembling the effect of silver nitrate applications or caustic gargle. A history was elicited of recent arrival from the States and the use of a gargle, exact ingredients unknown. Smear of the tonsillar lesions revealed the presence of spirilla of Vincent and fusiform bacilli. The patient was therefore treated for Vincent's angina, such treatment consisting of gentian violet locally, sodium perborate gargle, and sulfathiazole powder. He was seen off and on as an outpatient for about 2 weeks showing no improvement. A Kahn test was performed and when it was reported 4 plus, a dark field smear was made of the lesions. To the medical officer's surprise, many motile *Treponema pallida* were found.

A careful history was then taken and a story of sexual exposure 3 months prior to date of admission was obtained. A small penile lesion had developed approximately 3 weeks after exposure. This healed without treatment and no further symptoms were noted until this admission, 3 months after the initial infection. The patient was admitted to the hospital on the G. U. service, given 0.03 gram of mapharsen intravenously on the day of admission and 0.06 gram 4 days later. This latter dose was repeated every week thereafter. He was also given a neoarsphenamine throat gargle at the time of admission.

The throat lesions disappeared within 24 hours following the second injection and dark fields were subsequently negative.

Case 2.—A machinist's mate, second class, was first seen by a medical officer on 15 July 1943. Because of bilateral cervical swelling during an epidemic,

mumps was suspected and the patient was hospitalized. It was noted after hospitalization that he had "large edematous tonsils covered with a membrane, grayish and follicular in character." His diagnosis was changed to acute tonsillitis and he was treated for that condition being discharged from the hospital 3 days later with the note that he was clinically well but still had some tonsillar membrane persisting (W. B. C. 8100 at that time). He was seen by his local medical officer for persistent sore throats and was referred to our activity in September 1943, 2 months later, for diagnosis and tonsillectomy if indicated. Because of the familiar appearance and bilaterally symmetrical distribution of the tonsillar lesions, a dark field examination and blood Kahn were immediately performed. They were both positive. Subsequent examination showed condylomata about the anus and a generalized lymphadenopathy. History was then obtained of exposure about 1 July 1943 and a small nonpainful penile ulcer 3 weeks later, healing after 5 or 6 days. His immediate treatment was the same as for the previous case, the tonsillar lesions gradually disappearing after the second injection.

Case 3.—An electrician's mate, second class, was first seen in August 1943 with the complaint of hoarseness becoming gradually worse during the ensuing 6 weeks. He reported to the sickbay irregularly at odd hours and was treated by the hospital corpsmen with steam inhalations and gargles. When no definite improvement occurred, the medical officer was consulted who noted marked laryngeal pathology and referred the patient to our department for diagnosis and treatment. On routine ear, nose and throat examination prior to mirror visualization of the larynx, irregular, grayish, superficially ulcerated patches were noted on both tonsils and both anterior and posterior pillars. Indirect laryngoscopy showed intense redness of the interior of the larynx and the ventricular bands, and an edematous, mucous polyp was seen on one vocal cord. Redness and swelling was noted in the inter-arytenoid space. There were two bilaterally symmetrical ulcerations at the midposition of both vocal cords.

Again, the familiar appearance of the tonsillar lesions dictated that the laboratory be called upon. Again, the dark field microscope and the Kahn test showed positive results.

Subsequent careful inquiry revealed that a swelling of the prepuce had been noted on 22 December 1942. The swelling subsided with the application of hot compresses, and an ulcer, thought to be caused by burning with the hot compresses, had been seen on the foreskin. This sore lasted until March 1943. In May 1943, he was circumcised and in the same month a skin rash, first noticed on his shoulders and back and later over his entire body, developed. The throat symptoms developed following an upper respiratory infection about 1 September 1943, fully 8 months after the initial lesion.

This patient also had a moderate amount of fever and generalized adenopathy. He was treated for his syphilis with heavy metals initially and mapharsen subsequently. He was examined by me 2 weeks after the start of treatment. Both the pharyngeal and laryngeal lesions had subsided and darkfield findings were negative at that time.

In conclusion, let me repeat that anyone can overlook secondary syphilis when it appears in the throat alone. The lesions are usually minimal, give only slight symptoms, and occur at such a late period following the primary lesion that history is vague. I firmly believe that I as well as many others have seen the condition more frequently

than we have diagnosed it. If borne in mind, less mistakes will be made and fewer cases of syphilis allowed to progress to the degenerative vascular and cerebral stage.



AMELOGENESIS IMPERFECTA

REPORT OF A CASE

JULIUS F. MILLER

Lieutenant (DC) U. S. N. R.

At the U. S. Naval Training Center, Brainbridge, Md., the Dental Division under the direction of Capt. John A. Walsh (DC), U. S. N., was afforded an opportunity in the Steward's Mates Training School of observing a case of "Congenital Missing Enamel."

CASE REPORT

The patient, age 26 years, colored, married, father of two children, presented himself at the dispensary for the usual routine oral examination.

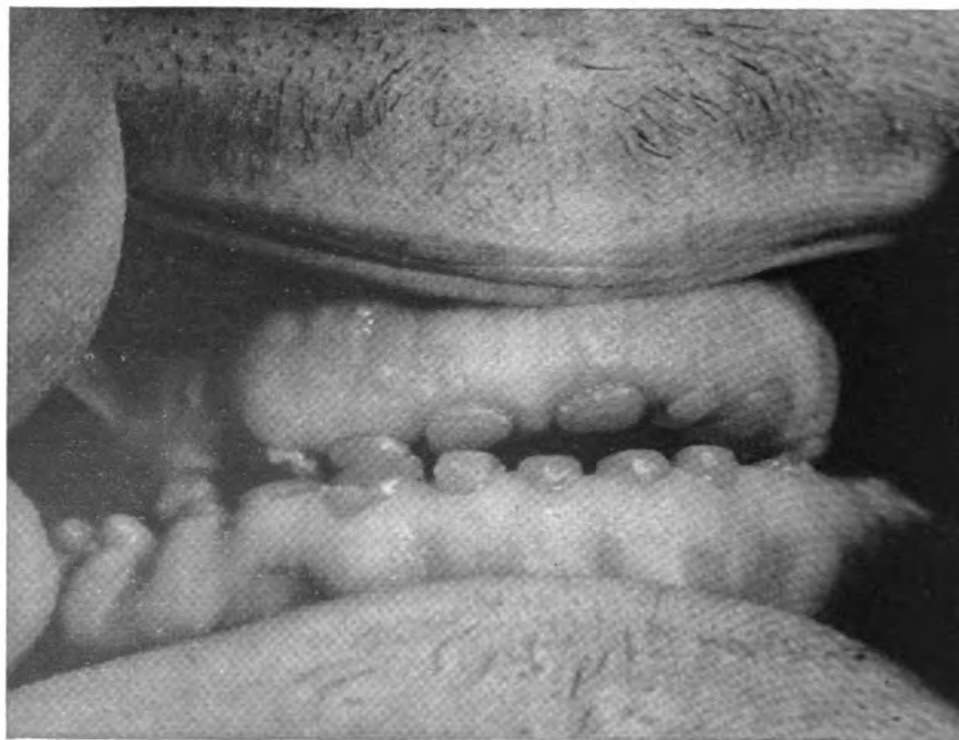


FIGURE 1.



FIGURE 2.

Clinical examination revealed almost complete absence of enamel, with the teeth appearing as truncated cones. Anteriorly the bite was open 1 to 2 cm., and contact between the upper and lower jaws was in the region of teeth Nos. 17, 18, and 19. On the left side there was a cross bite with lack of occlusal contact (figs. 1, 2, 3).

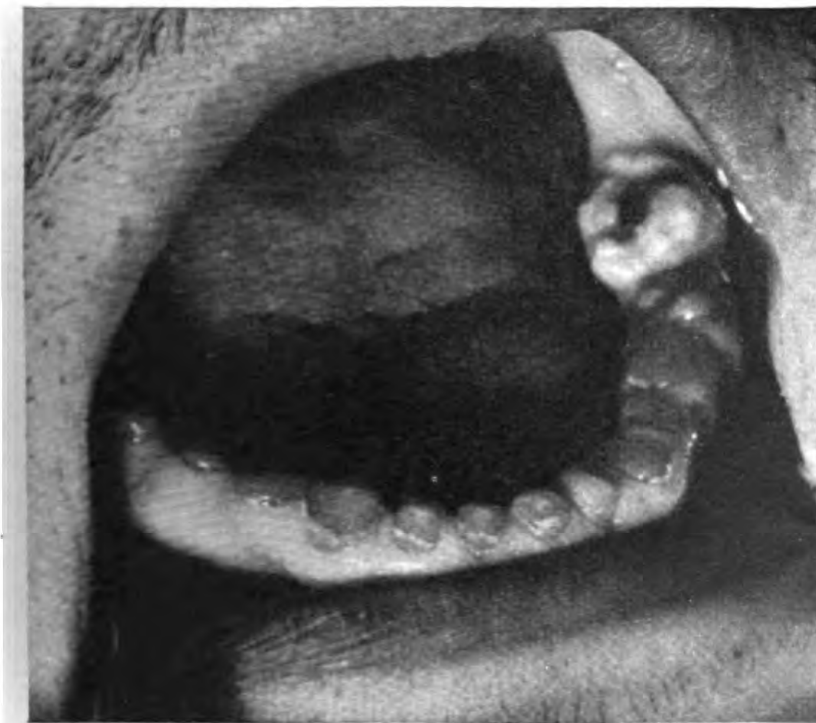


FIGURE 3.

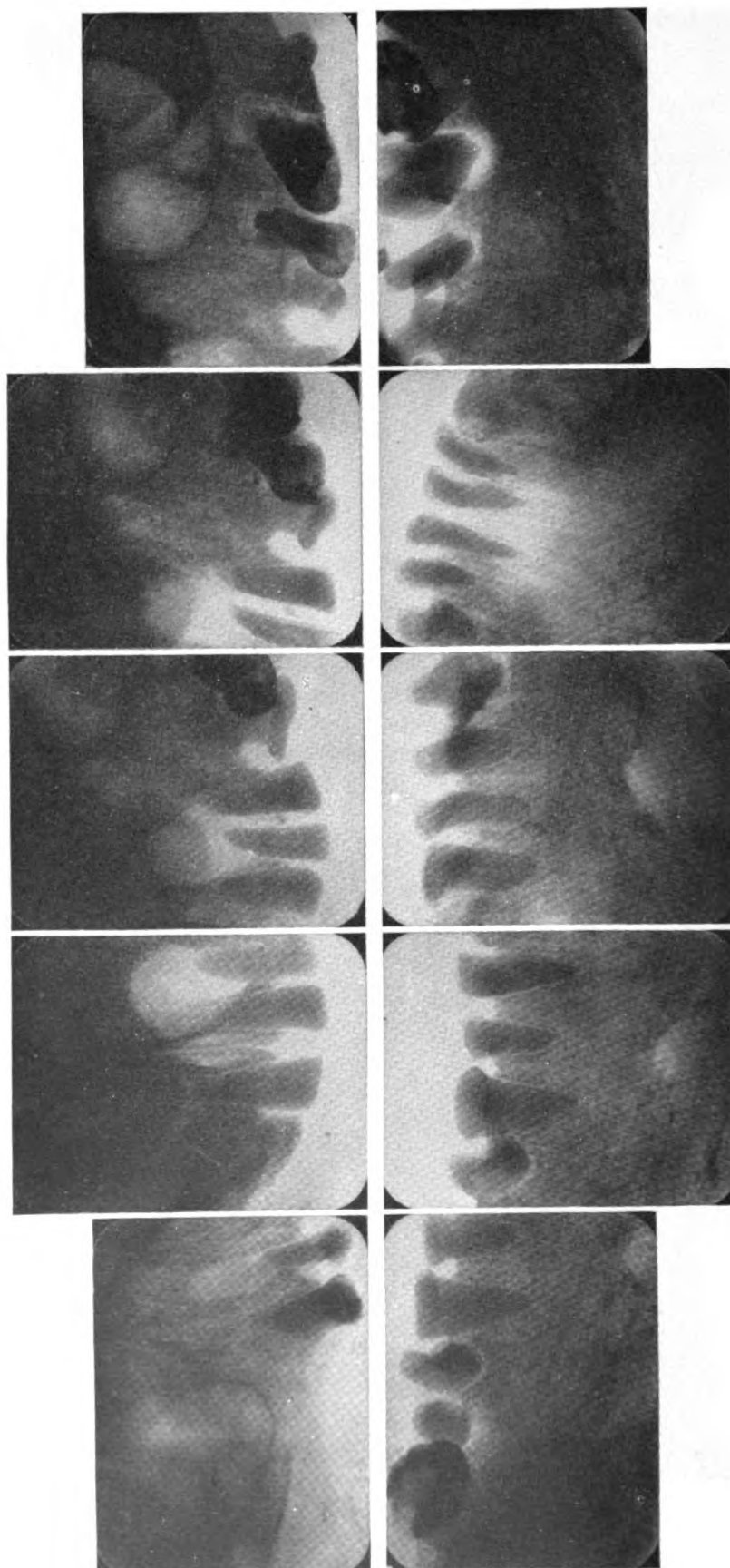


FIGURE 4.—Radiographs of upper and lower teeth.

Past history.—The deciduous teeth had the same appearance as the permanent ones. Father, grandmother, and two children exhibited the same characteristics as the patient. He also had had the usual childhood diseases of measles, whooping cough, parotitis, smallpox, and pneumonia.

Present history.—This patient also suffered from gastro-intestinal disturbances, eczema of the scalp, watery eyes.

Pulp tests.—On the Cameron Pulp Tester the following results were obtained: Tooth No. 2, partial vitality; tooth No. 4, partial vitality; and teeth Nos. 28, 29, 32, very slight vitality. All other teeth were nonvital.

Radiographs.—X-ray examinations revealed shortened crowns and roots, with pathosis on many teeth and adjacent areas (fig. 4).

Diagnosis.—Amelogenesis imperfecta.

Definition.—An abnormal condition of the teeth in which the enamel formation and calcification is defective. There are two types, one which affects the formation of the enamel and the other which is concerned with the calcification of the enamel.

Incidence.—The condition is found in male and female. It is a Mendelian dominant character anomaly.

Complaint.—The patient complains of an unesthetic appearance of the teeth.

Cause.—Unknown.

Location.—All the teeth of the deciduous and permanent dentitions are affected.

Related medical history.—There may be other ectodermal dysplasias affecting the hair, the skin, or the eyes.

Description.—One type of amelogenesis imperfecta, presents crowns that are yellow-brown, smooth, glossy, hard, and whose shapes resemble teeth prepared for jacket crowns. The second type of amelogenesis imperfecta presents teeth with crowns that are dark brown, dull, and rough. The enamel is easily removed. Both types of amelogenesis imperfecta present teeth that are shaped like truncated cones. The contact is missing between teeth and they have normal pulp chambers. They are sensitive to extreme heat and cold because of the absence of enamel.

Course.—The condition remains unchanged until the teeth are lost, if no dental restorations are introduced.

Duration.—The condition lasts as long as the teeth are present.

Pain.—No pain is present.

Distinguishing characteristics.—Absence of enamel from deciduous or permanent teeth. In radiographic examinations the crowns appear shortened and separated because of the absence of enamel.

In the first type an abnormally thin layer of occasionally hypocalcified enamel is found over the dentin. The enamel is covered with cementum and shows resorption. A large percentage of permanent teeth are imbedded. The appositional function of ameloblasts is arrested prematurely. This condition is called hereditary generalized enamel hypoplasia.

In the second type, radiographically and histologically, the amount of enamel formation is normal but it remains in the matrix stage. The dentin, pulp, and cementum are normal. This abnormality is due to a disturbance in calcification of developing enamel. This condition is termed hereditary enamel hypocalcification.

Differential diagnosis.—The teeth are deficient in enamel. It differs from attrition in that x-rays show the same defect in unerupted teeth. It is inherited and not acquired as in fluorosis or transitional hypoplasia. Pulp chambers and

dentin are normal as contrasted to odontogenesis imperfecta in which the pulp chambers and dentin are abnormal.

Treatment.—Full upper and lower extractions with alveolectomies were ordered to be followed later with upper and lower dentures. Three months after completion, the patient now has gained weight, feels physically well; that plus his improved appearance has changed his entire psychological outlook and restored a healthy individual to active duty.

REFERENCES

1. OLSON, J. J.: Aplasia of the enamel. *J. Am. Dent. A.* 25: 830–831, May 1938.
2. WEINMAN, J. P., and SVOBODA, J. F.: Hereditary amelogenesis imperfecta. *J. Dent. Research* 21: 306, June 1942.
3. WILLET, R. C.: Unusual infant diet and its questionable effects upon dentition. *Internat. J. Orthodontia* 20: 432–444, May 1934.



NOTES ON VOLATILE ANESTHETICS

Ether is one of the safest of volatile general anesthetics. On exposure to light and air, however, it develops peroxides which are explosive. Furthermore, it is highly inflammable. Ether has many advantages and by the open method of administration remains one of the safest general anesthetics and can be given with very inexperienced assistance. It has long been a standby of the country doctor and in war it has proved its value in the field.

Both of these drugs first saw their use as anesthetics in America. Chloroform was first used in Europe by Sir James Simpson. It is much more rapid in its action than ether. It is more cardiotoxic and through stimulation of the vagus slows the heart yet stimulates the cardiac acceleration. These simultaneous effects tend to produce fibrillation involving both auricles and ventricles and with the cardiotoxic effects on the muscle may cause sudden death. The mortality is apparently four times that of ether. The figures usually cited are 1 death in 10,000 cases from ether, and 1 in 2,500 from chloroform.

Ethylene was developed in 1922 by Luckhardt in the United States. This gas must be administered with oxygen. Unfortunately the mixture is very explosive and this has contributed to the unpopularity of this anesthetic.

Divinyl oxide was produced by Leake at the University of California from a combination of ethylene and ether. It is used in lower dosage than ether being considerably more profound in its effects. It produces a rapid anesthesia but causes liver damage if used except for very short operative procedures.

Cyclopropane is a hydrocarbon which produces anesthesia with good relaxation and sufficient oxygen can be given with it to prevent anoxia. It has recently been included in the USP XII.

MEDICAL AND SURGICAL DEVICES

A PNEUMATIC SPLINT FOR THE LEG

H. MERRILL SHAW

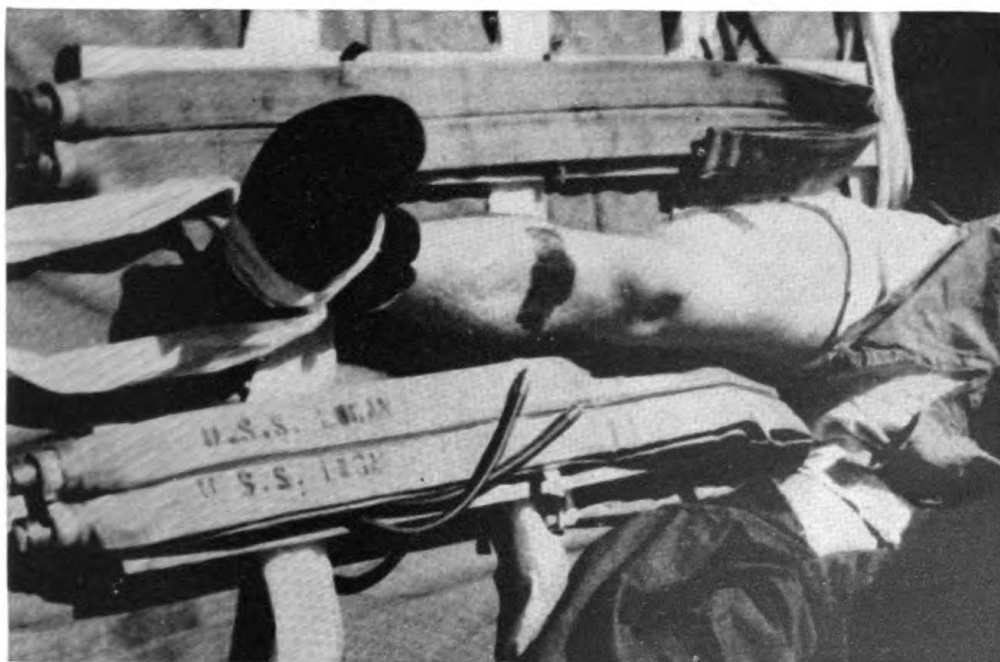
Commander (MC) U. S. N. R.

This article describes a splint for fractured and for wounded lower extremities which holds the leg firmly suspended between two tubes inflated with air, each backed by a rigid stiffener.

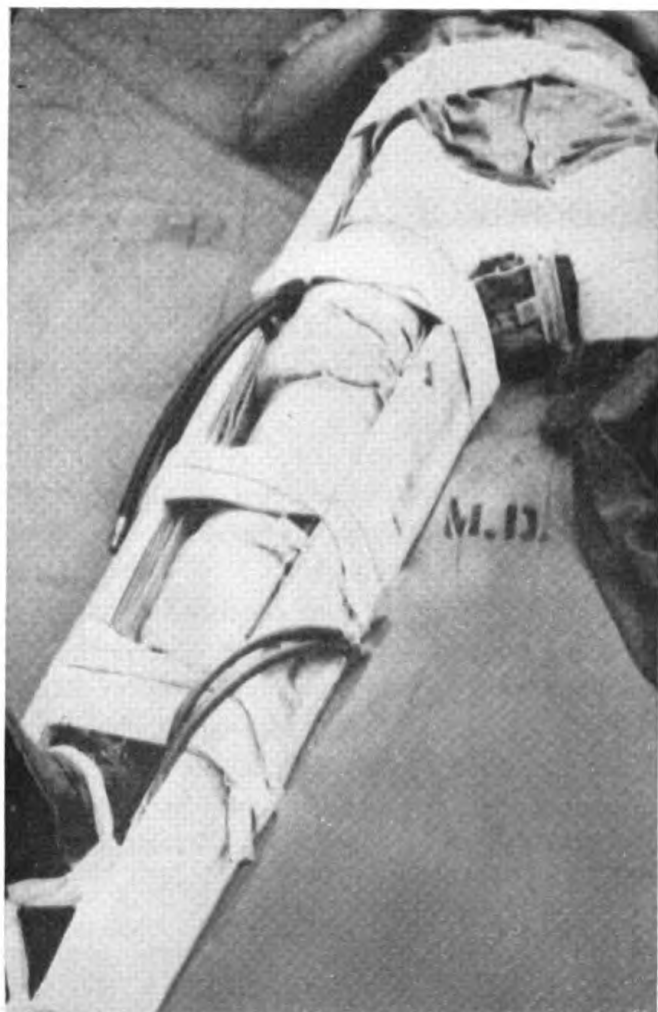
The splint offers several advantages. It can be applied without moving the patient's leg during the application. Wounds on the leg can be dressed and the dressings held in place without circular bandaging. The dressings are held by the pressure of the inflated tube, the compression of which aids greatly in effecting hemostasis.

No padding of bony pressure-points is necessary.

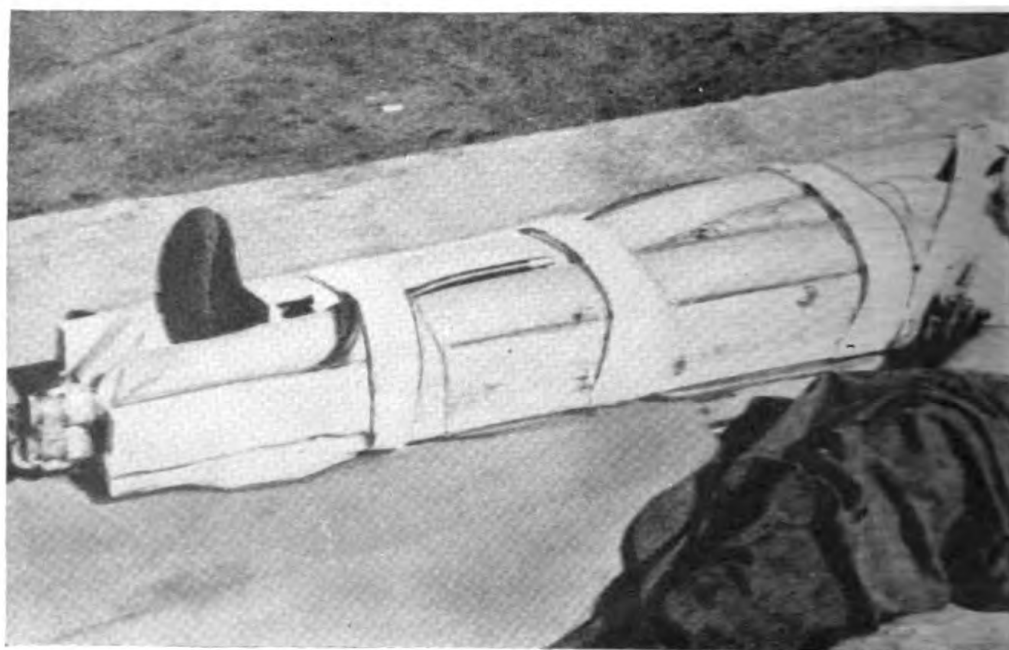
The tube applied to the medial side of the leg is folded over the upper end of the board which serves as the stiffener for the splint. When



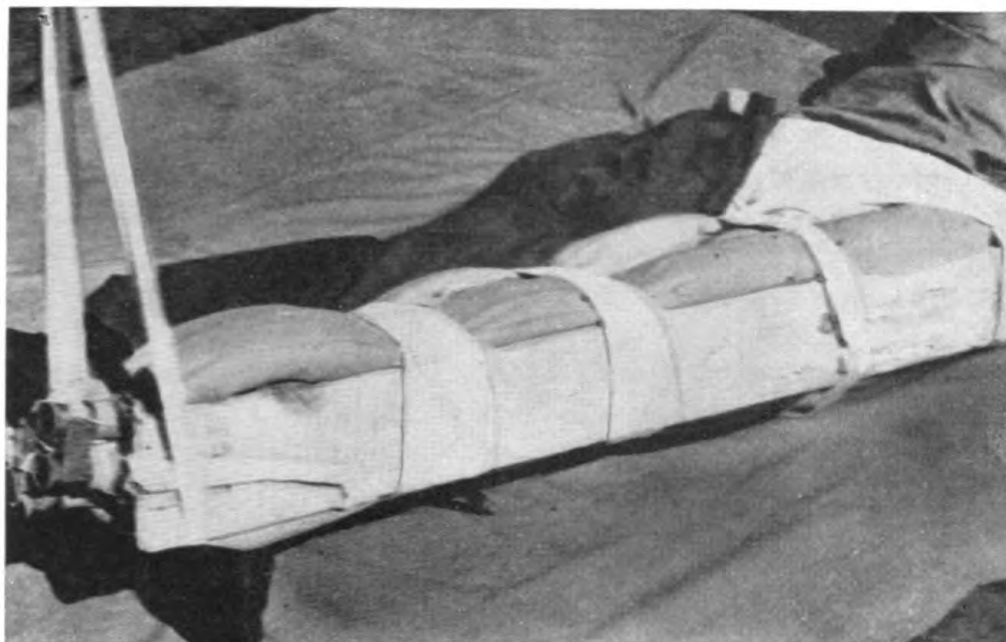
1. Double-tube life belts laid on boards, ready to be tied in place. A traction hitch has been placed on the foot in this case.



2. (Left) Double-tube life belts on boards tied in place and ready for inflation.

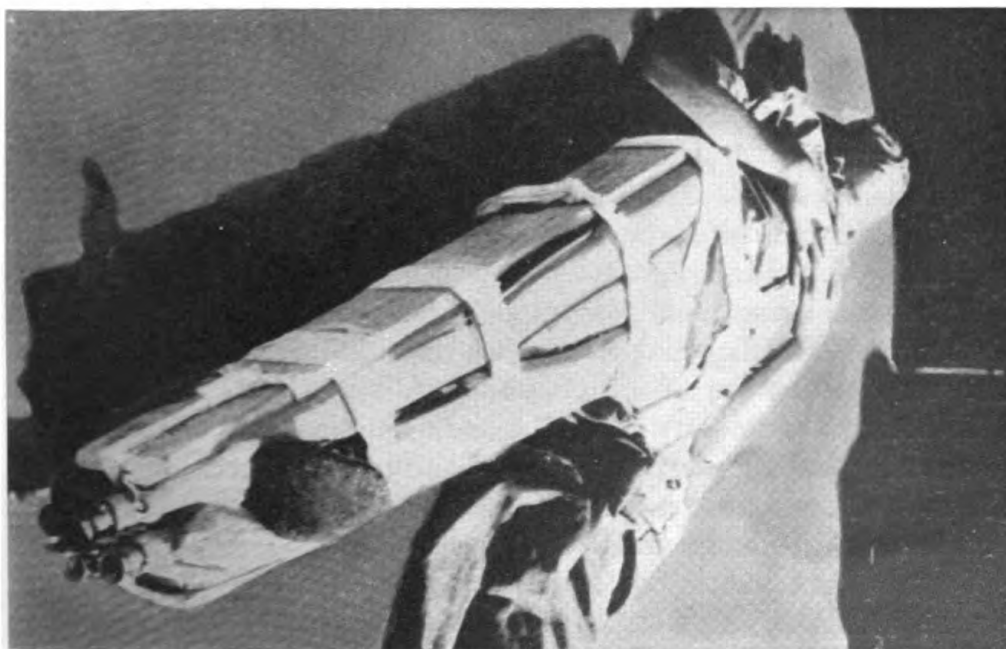


3. (Below) The air jacket or life belt splint applied to the leg and inflated.

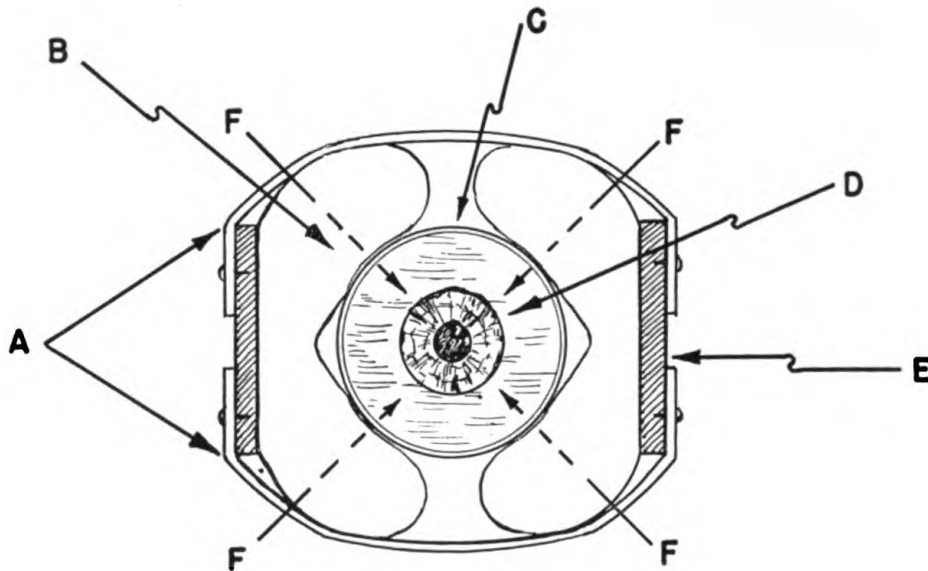


4. A posterior-lateral view of the inflated splint.

this unit is fitted to the crotch and filled with air, a comfortable self-form-fitting sack of air pads the crotch, to serve as a point of countertraction if it is desirable to hold the leg in traction while in the splint.



5. A splint tied in place and inflated. Note that the lateral unit of the splint extends above the pelvis and serves to immobilize the leg at the hip.



**A. STRAPS HOLDING
SPLINT TO LEG.**

D. BONE.

**B. COMPRESSED AIR,
IN RUBBER LIFE BELT.**

**E. BOARD OR METAL
STIFFENER.**

C. LEG.

**F. COMPONENTS OF FORCE
IN FOUR DIRECTIONS.**

6. Schema of splint applied to leg.

The tube applied to the lateral side of the leg is allowed to extend above the iliac crest. This tube is backed in its entire length by a board or stiffener, which serves the additional valuable purpose of immobilizing the leg at the hip (fig. 5).

If traction is applied through the foot or ankle in a direct line with the long bones during the period when the tubes are being inflated, the uniform distribution of air pressure aids remarkably in effecting a satisfactory alignment with reduction. Traction may be maintained by securing the traction harness to a small board or axle placed across the ends of the boards used as a backing for the rubber tubes. These boards should be long enough to extend a few inches beyond the foot.

Figures 1 and 2 show the application of the life-belt tubes as splints, before inflation. Figures 3, 4, and 5 illustrate the leg held in the splint, after inflation of the tubes.

It was found that very little air pressure was necessary to hold the leg immobile in this splint. There was no tourniquetting action on

any part of the leg. The resiliency of the inflated tubes extending anterior and posterior to the leg absorbed any jarring or discomfort from vibration while the patient was being transported. In fact, the comfort to the patient was one of the noteworthy features of this method of splinting that made us enthusiastic about its application. The ease with which reductions were accomplished by the air pressure exerted upon the bones in four directions (fig. 6) while longitudinal traction was being applied was another material advantage. Further, the freedom from pressure sores or the need for padding material, and the ready availability of the life belts on the beach were all advantages that made this a handsome form of splinting when caring for casualties during amphibious operations.



PLASMA, A NUTRIENT DUSTING POWDER

USED TO NULLIFY THE RUBBER CEMENT USED IN CONNECTION WITH THE
PADGETT DERMATOME

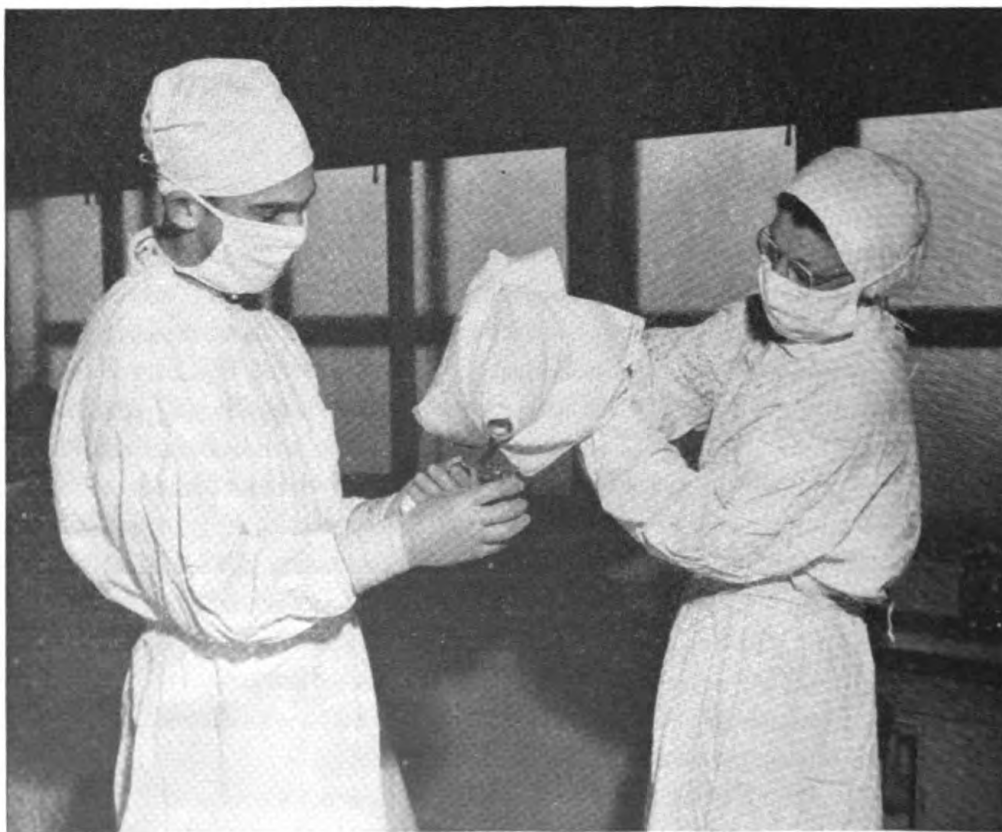
SAMUEL CLIMO

Lieutenant Commander (MC) U. S. N. R.

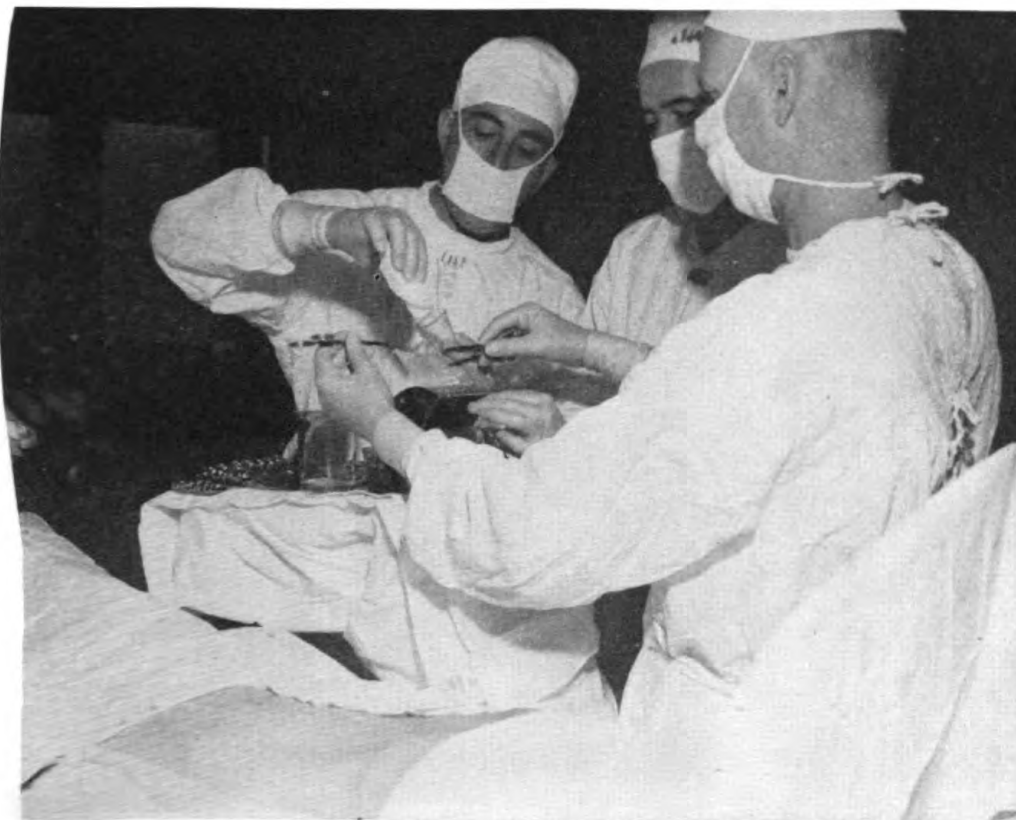
Since the epoch-making contributions of Blair and Brown (1) renewed thought and impetus have been aroused concerning the transplantation of autogenous skin in split-thickness form to save life, shorten convalescence, and render many more patients capable, physically and mentally, to resume their proper places in civilian life. A great advance followed a decade later when Padgett (2) produced his dermatome. By means of the latter it has become scientifically possible to elevate large sheets of uniformly calibrated skin. The predetermination of the thickness of the grafts has simplified the demands for structural support, functional needs, and cosmetic appearance. The desired split-thicknesses have been studied more scientifically and confirmation of results have been more universally appreciated. The dermatome has proved its eminent position in the surgeon's armamentarium throughout the world as attested by the voluminous literature incident to its efficient use.

At the U. S. Naval Hospital, Long Beach, Calif., the Padgett dermatome, has been used with gratifying results, but there had previously existed one technical drawback. Unless handled with ex-

treme care, the lifted graft, whose external surface was covered with the very sticky rubber cement, would adhere to itself. Attempts to restore the original surface were futile once cohesion had taken place, and the graft was lost in part as a consequence of the resultant shredding and tearing. During the maneuvers of peeling the sheet of skin from the drum and transferring it to the recipient bed great caution had to be exercised. Considerable loss of time ensued besides the loss of the precious graft, accounting for the discomfiture of many writers in the recent literature who honestly mention their difficulties. A search has verified the universal recognition of this fault with the concomitant efforts to circumvent it. Padgett (3) indicates the use of talc and ether when describing the lifting of a definite pattern of skin graft. A direct warning is sounded by Brown and McDowell (4). Rubin (5) offers, in passing, his use of dry gauze and friction, with or without sulfa as an abrasive, as a means of ridding the skin of the adherent cement. Many writers mention the use of sulfa drug in its various forms as a dusting powder. Obviously the defect is real, as real as viable graft and precious operating time. Childhood experiences with fly-paper can also be amusing, but only in retrospect.

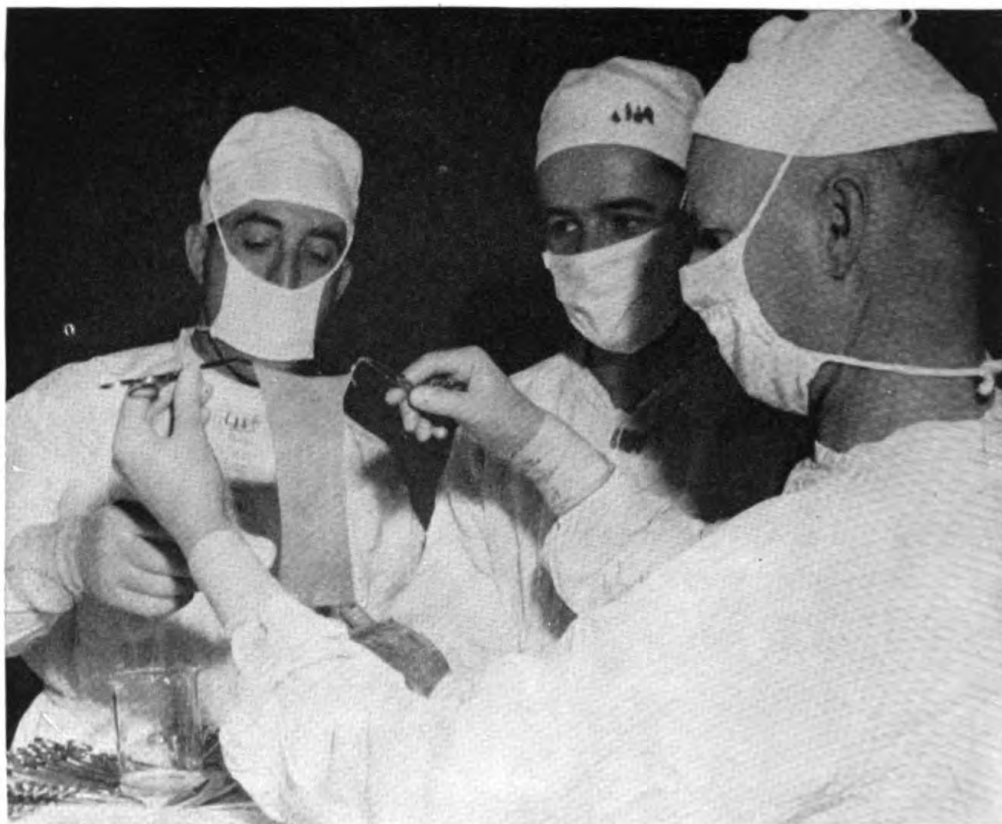


1. Contents being shaken out of draped and prepared dried plasma container.



2. Powdered dried plasma, shaken over sticky surface of graft, about to be distributed with rolled sterile gauze in the manner of a brush.

To nullify the adhesiveness of the rubber cement the author has used, with eminent satisfaction, dried human plasma. Available in commercial form in unlimited quantity, the desired amount, which never exceeded 1 ounce, is removed from the container while at the operating table. The neck and rubber cap of the commercial container, which is held by an unscrubbed hospital corpsman or nurse, is prepared and draped as for a sterile field, using ether and merthiolate tincture. A sterile towel, fixed by a towel clamp about the neck of the bottle, covers the container and the hand holding it completely (fig. 1) The scrubbed hospital corpsman or nurse then removes the rubber stopper with a Kocher forceps or Allis clamp and, holding a sterile beaker, catches the dried plasma as it is shaken out. The lumpiness of the plasma can be broken up by any long slender instrument introduced into the mouth of the bottle. After the first withdrawal of plasma, sterilized steel shot can be placed in the bottle and will aid in the pulverizing process by agitation of the container prior to future use. There is nothing complicated about the technique as common operating room principles are employed. The commercial container is



3. Skin graft ready for transfer to recipient area.

never touched by the scrubbed assistant. Only a few minutes are required to carry out the complete technique making available for the surgeon a nutrient dusting powder which answers his every need for the moment, not only to render the graft facile but also to remove any stickiness from gloves and instruments.

While the sheet of split skin is gently lifted from the drum with mosquito forceps, the assistant applies the powdered plasma to the presenting gummy surface by shaking some from the glass container (fig. 2) and lightly distributing it over all the exposed cement area, using a folded piece of sterile gauze in the manner of a brush. With easy strokes this maneuver eliminates entirely the former stickiness and assists in the peeling process by the application of gentle pressure. The effect is immediate and irreversible and the amount of plasma used is negligible. The result is the facile preservation of the entire split-thickness graft, which can be handled with impunity thereafter in the transfer to the waiting recipient area, and a great reduction in time previously required to perform the operation (fig. 3).

SUMMARY

1. The Padgett dermatome is indispensable where split-thickness skin grafting is done, particularly where there are many cases of burns and trauma requiring plastic repair.

2. One fault in its use has been generally recognized, the excessive stickiness of the cemented surface of the graft during the process of removal from the drum and transposition to the recipient bed.

3. This fault has been responsible for partial loss of grafts and great loss of time.

4. By using commercial dried human plasma, as described, the adhesiveness of the rubber cement is immediately and irreversibly nullified.

5. Since plasma is also nutrient (9) (10) no disadvantages are discerned.

REFERENCES

1. BLAIR, V. P. and BROWN, J. B.: Use and uses of large split-skin grafts of intermediate thickness. *Tr. South. S. A.* 41: 409-424, 1928; also, *Surg., Gynec. & Obst.* 49: 82-97, July 1929.
2. PADGETT, E. C.: Calibrated intermediate skin grafts. *Surg., Gynec. & Obst.* 69: 779-793, December 1939.
3. PADGETT, E. C.: *Skin Grafting from a Personal and Experimental Viewpoint.* Charles C Thomas, Springfield, Ill., 1942.
4. BROWN, J. B. and McDOWELL, F.: *Skin Grafting of Burns; Primary Care, Treatment, Repair.* J. B. Lippincott Co., Philadelphia, 1943.
5. RUBIN, L. R.: Simplification of split-skin grafting; gum acacia. *Am. J. Surg.* 70: 302-307, December 1945.
6. JENNEY, J. A.: Modification of plasma fixation method (Sano) of skin grafting by use of bobbinet and mirror attachment. *Am. J. Surg.* 67: 3-7, January 1945.
7. ROBERTS, W. M. and SCHAUDEL, H. J.: Vaseline gauze contact fixation of split thickness (Padgett) skin grafts. *Am. J. Surg.* 67: 16-22, January 1945.
8. CONVERSE, J. M.: Skin graft of dorsum of hand; use of large-size dermatome to obtain one-piece patterns, *Ann. Surg.* 121: 172-174, February 1945.
9. SANO, M. E.: Skin grafting; new method based on principles of tissue culture. *Am. J. Surg.* 61: 105-106, July 1943.
10. SANO, M. E.: Coagulum contact method of skin grafting as applied to human grafts. *Surg., Gynec. & Obst.* 77: 510-513, November 1943.
11. MCPHEETERS, H. O. and NELSON, H.: Blanket split skin graft for covering large granulating areas. *J. A. M. A.* 117: 1173-1174, October 4, 1941.
12. ZINTEL, H. A.: Resplitting split-thickness grafts with the dermatome; method for increasing yield of limited donor sites. *Ann. Surg.* 121: 1-5, January 1945.
13. CLARK, A. M. (Glasgow), MILNE, G. R., and TODD, J. P.: Fixation of skin grafts with human plasma and thrombin. *Lancet* 1: 498-499, April 21, 1945.
14. KOCH, S. L.: Transplantation of skin and subcutaneous tissue to the hand. *Surg., Gynec. & Obst.* 72: 1, January; 157, February 1941.

ACKNOWLEDGMENT.—Gratitude is expressed to Commander John W. Whitsett (MC) U. S. N. R., for his kind encouragement, cooperation, and permission to assist him on his cases requiring skin-grafting, and to Capt. O. H. Fulcher (MC) U. S. N. R., Chief of Surgery, for his constant interest and expert guidance.



AN IMPROVISED SPRAY RIG FOR THE DISPERSAL OF DDT SOLUTIONS BY AIRPLANE

RANSFORD J. HEMMINGS

Lieutenant H(S) U. S. N. R.

Although plans were being made for spraying during the early stages of combat by fast, heavy planes in the operation in which this division was preparing to take part, no spray plane or equipment for use in a plane was available to the division for its own immediate use and protection. Therefore, efforts to improvise spray plane equipment were undertaken by Malaria and Epidemic Control Unit 17, Third Marine Division. While it is generally agreed that light reconnaissance planes are not practicable for spray work during the first part of an operation because of their low speeds which make them easy targets when flying low, their use later on to supplement the work of the larger planes was contemplated. Planes of the OY-1 Sentinel type, available as part of the observation squadron attached to the division, are especially well adapted for spraying because of their low speeds, maneuverability, and low altitudes, and the comparatively short time required for servicing them between flights. At the same time this type of plane has sufficient horsepower to enable it to carry enough spray material to make a single flight effective and worthwhile.

In devising a spray rig it was necessary to take into consideration not only the load-carrying capacity of the OY-1 but also the effect upon its flight characteristics of any device that might be installed. Earlier experiments by malaria-control personnel in the Fourth Marine Division had developed a rig using 2 water-fill practice bombs, 500-pound size, mounted under the plane just inside each wheel support as tanks for the spray material with an electrically operated magnetic valve of the fuel-diverter type installed in the tail end of each bomb as outlets for the spray. The steamlining of the bomb would offer very little resistance to the forward motion of the plane. However, since it was

impossible at the outset of these experiments to obtain water-fill bombs in the forward area, the idea of externally mounted tanks was at first abandoned. Instead, two magnetic valves were attached to a 50-gallon aluminum tank which was mounted in the observer's space within the plane. A common outlet for both valves was provided through a 1½-inch aluminum pipe projecting about 1 foot below the floor of the plane's fuselage. The advantages of quick and easy installation were lost in this arrangement, however, since it was necessary to remove the observer's seat and control stick in order to accomodate the tank.

Furthermore, modification of the valves was required in order that they could be opened and closed by the 12-volt electric system of the Sentinel plane and this modification included cutting a small ⅜-inch hole in the upper chamber wall of each valve to reduce the pressure on its diaphragm, thus permitting a small amount of spray material to be exhausted each time the valve was in operation. Damage to the interior and fabric of the plane by solvents in the spray material appeared certain from this arrangement unless the valve could be mounted outside of the fuselage. The single outlet in the center of the plane had the added disadvantage of providing only a narrow swath when spraying was attempted whereas the original plan with



1. Front view of tank suspended beneath fuselage of plane.



2. Side view of suspended tank.

water-fill bombs on either side of the plane inside the wheel supports would allow for 2 spray streams and give a wider coverage in each swath.

The device finally found to be most advantageous from all these standpoints was constructed from materials available at most any airfield. A 50-gallon oil tank, elongated and flattened in shape, taken from a dismantled C-54 transport, was attached beneath the fuselage of an OY-1 by means of 4 supporting brackets fastened to the frame work of the plane (figs. 1 and 2). Straps around the tank, one at either end, met these brackets and were fastened by strong bolts to them. By the simple process of unfastening these bolts, eight in all, the tank can be dropped in a few minutes should it be necessary to use the plane for other work. Two outlets for the spray material, about 42 inches apart, were provided by mounting a magnetic valve in a supporting bracket on either side of the tank toward the rear. These valves were operated by means of a switch in the pilot's cockpit. A 2-inch elbow, three-fourths of an inch in diameter, was inserted in the outer opening of each valve to serve as a nozzle. The tank was already fitted with a float gage and filler cap and, except for the fastening of the brackets for the tank and valves, very little work on the

plane was necessary. The valves, however, required considerable modification since they were designed to operate on a 24-volt electrical system whereas the OY-1 uses only 12 volts. Several trials and tests were necessary before these valves could be made to operate satisfactorily at about 9 to 11 volts. A number of extra valves were modified and held in reserve in the event those in use should fail to operate as desired.

The plane can easily carry 50 gallons of spray material in this tank without too much effect upon its flight characteristics. Pilots reported some difficulty in gaining altitude rapidly, a fact which places some limitations upon the plane when spraying over deep valleys and ravines. Over level ground the plane was handled quite easily. Photographs of the plane in action (fig. 3) had to be made at a height considerably higher than that at which spraying was ordinarily done in order to allow for the safety of both the photographic plane and the spray plane while flying close in echelon over extremely uneven terrain.

Preliminary flights with this rig were made over the area occupied by the observation squadron, covering the territory between a highway and the taxiway of the field with dimensions about one-fourth of a mile in length and 600 feet in width and with a fairly heavy growth of palm trees at either end. Flights were made at a height just above the tallest trees and a speed of about 85 miles an hour was maintained. With little or no breeze blowing the droplets seen falling upon nearby puddles and roadside ditches were small enough and so equally well distributed as to indicate that this device would be useful and effective for the treatment of breeding places with definite boundaries, or,



3. Plane in flight over a deep river valley.

should the need arise, for widespread spraying of larger areas. The two spray streams emerging from the nozzles were broken up into a thick fog by the propeller blast and merged into a single spray some distance behind the plane. Swath width was approximately 30 feet on level ground. Larger droplets were first to fall to the ground and penetration through foliage was uneven. A slight cross wind during the later flights appeared to aid in overcoming this by swirling the spray through openings in the treetops.

To test the effectiveness of the spray rig in reducing adult mosquitoes, flights were made on several evenings over bivouacs of troops in the field on maneuvers. This part of the day seemed best for spray work, especially for adult control, not only because the most common species of this area are most active during the hours of semidarkness but also because spraying is more effective after the breeze has dropped and air temperatures are lower. Reports from ground observers in these bivouacs indicated that mosquito annoyance ceased almost immediately after the completion of spraying. A good film of spray material was found on the surface of pools and puddles in the bivouacs after the passing of the plane. No larvae of the tree-breeding *Aedes pandani* mosquitoes could be found in axils of pandanus trees within the sprayed area after this treatment.

A routine spraying of a river valley within the division area was made to control larvae which ordinarily are found in meadowlands and flooded spots along the river's edge. Although the projecting ridges and steep hills along this valley forced the pilot to fly somewhat high, the spraying was so effective that only two small spots retained live larvae upon inspection the next day. A mixture of 50-percent kerosene and 50-percent fuel oil with 5-percent DDT in solution was used and later 2 quarts of 3-percent pyrethrum concentrate was added to each 50 gallons of spray material. This was expected to act as an irritant, increasing the activity of the adults especially so that they would come into contact with more of the DDT crystals than they would otherwise in a short period. It was found that extreme care in mixing spray material was necessary in order to prevent small particles of dirt from clogging the delicate mechanisms of the valves. Kerosene and fuel oil from sealed drums had to be used in preparing solutions and in spite of all efforts some particles did eventually accumulate within the chambers of the valves necessitating their removal for cleaning.

ACKNOWLEDGMENT.—These experiments and the spray work following were made possible by the close cooperation of the officers and men of Marine Observation Squadron One, First Lt. Anthony Barrett, U. S. M. C. R. and later, Capt. R. K. Morris, U. S. M. C. R., commanding. Their interest resulted in many valuable

suggestions for the assembling and improving of this rig. Pilots of the squadron displayed a keen interest in the entomological problems involved in plane spraying and devoted many hours to the work, both on the ground and in the air. Personnel of the hydraulic and engineering sections of CASU 12 assembled and attached the spray rig to the plane and modified the valves. The idea for use of the magnetic valves was first proposed in reports on experiments with airplane spray apparatus made by Lt. John Hutzel, U. S. N. R., while attached to the Fourth Marine Division.



CH'ANG SHAN, A CHINESE ANTIMALARIAL HERB

Ch'ang Shan, the roots of *Dichroa febrifuga* Lour., has long been used in China for malaria, but as far as we are aware, no scientific studies had ever been made on its antimalarial action until 1942, when a solid extract of this herb was tried on 13 clinical cases of tertian malaria. A dose of 0.03–0.06 gram of the extract (equivalent to about 7.5–15.0 grams of the crude drug) was administered by mouth twice or three times daily for an average of 5 days. In comparison with the results of 152 quinine-treated cases, Ch'ang Shan appeared to be as prompt as quinine in controlling the fever, but its antiparasitic effect was a bit slower, requiring one more day than quinine in converting positive smears into negative.

Both the antipyretic and antiparasitic effects of Ch'ang Shan were demonstrable in experimental animals. A simple decoction of the crude drug was able to reduce the febrile temperature of rabbits inoculated with *B. coli* vaccine. Chicks infected with *Plasmodium gallinaceum* run a course of malaria which is almost invariably fatal if not treated. Ch'ang Shan (1 gram per kilogram), given by stomach tube twice a day for 1 to 7 days, controlled the infection in all cases, as shown by the conversion of positive smears into negative and the prolongation of the survival periods. Such treatment did not, however, prevent relapses, which usually occurred sooner or later. In doses only about one-fifth that of Ch'ang Shan, the leaves of the same herb (Shuu Chi) were found equally effective.

With a view to isolating the active principle or principles, our chemical studies were checked at every step by testing on chicken malaria. Up to the present time we have succeeded in isolating from both Ch'ang Shan and Shuu Chi four crystalline substances. Two of these are neutral principles: Dichrin A (m. p. 228–230° C.) and Dichrin B (m. p. 179–181° C.); the other two are alkaloids: Dichroine A (melting at 230° C. with decomposition) and Dichroine B. (melting at 237–238° C. with decomposition). In the doses tried, only Dichroine B was found to be effective for chicken malaria, while the other three were all inactive.—JANG, C. S., FU, F. Y., WANG, C. Y., HUANG, K. C., LU, G., and CHOU, T. C. (Pharmaceutical Laboratory, National Institute of Health, Chungking, China): Ch'ang Shan, a Chinese antimalarial herb, *Science* 103: 59, January 11, 1946.

EDITORIALS

MILESTONES IN OUR KNOWLEDGE OF THE CIRCULATION OF THE BLOOD

It was in 1628 that William Harvey announced his experimental proof of the discovery of the circulation of the blood. "Which discovery," says old Sir Thomas Brown, "I prefer to that of Columbus."

Ideas that the blood circulated in the body were not unknown to the ancients. It was Harvey, however, who demonstrated the circulation of the blood by actual experiment. Seventy-five years before Cesalpino, the great Italian physiologist and botanist, had theoretically described a circulation of the blood though he seems to have had a sort of ebb and flow movement in mind rather than a true circulation of the blood very much as Harvey proved it to exist. Thirty-three years after Harvey's announcement another great Italian scientist, Malpighi, described the capillary circulation, the next milestone in knowledge regarding the circulation of blood. In 1946, 285 years after Malpighi observed and described the capillary circulation, the next most considerable advance in the history of the movement of the blood in the human body was recorded.

At the University of California, Dr. Hardin Jones and Dr. John H. Lawrence, by the use of radioactive tracers have followed the course of the blood and brought to light some new and interesting facts. The three principal ones are:

(1) That each organ has what amounts to a reserve supply of blood and this forms a central pool containing about 70 percent of the blood volume.

(2) The remaining 30 percent is contained in the extremities and other parts of the body.

(3) That there is rapid gaseous interchange to and from the bloodstream to body cells.

The use of radioactive isotopes and elements as tracers has remarkable possibilities in research, in diagnosis, and in therapeutics, and work in these fields has only just begun. This new step in the long history of our knowledge of the circulation of the blood is one of the first of these possibilities which have been realized.



HEALTH AND MEDICAL CARE IN GERMANY UNDER HEAVY BOMBING

A report of the results of the effects of bombing on health and medical care in Germany has recently been published by the War Department. It is a large volume and contains a great many maps and much important statistical information. It indicates that the damage, particularly in many large cities, was very extensive and that the loss of life was extremely heavy. It is estimated that a half million German civilians were killed by aerial attacks by the end of the war. Heavy damage was done to large centers of population and public water supplies, waste disposal systems, transportation and communication systems, stores of medical supplies, of food, and in many instances to hospitals and medical schools.

It would be supposed that as a consequence, an ideal situation for serious epidemics on a large scale would have prevailed and that there would have been a great increase in morbidity from epidemic diseases. Such, however, was not the case and surprising as it seems, extensive outbreaks of typhus, typhoid, smallpox, dysentery, or other serious epidemic diseases did not occur.

There seem to have been several reasons for this relative immunity from epidemics. Although no definite conclusion can be reached professional speculation has not been idle, and some of the reasons for this freedom from disastrous epidemics are fairly clear. First, was the fact that Germany had long possessed a well-organized public health service. As a consequence the population had been well immunized against such diseases as smallpox, diphtheria, typhoid, and similar conditions and diseases. Carriers had been eliminated as far as possible.

Another factor was in the nature of the people themselves, who, docile and accustomed to taking orders, observed all instructions regarding public health. Instructions regarding disease prevention such as boiling water, taking a vaccine or carrying out other preventive measures were universally observed.

Another factor were the habits of personal and public cleanliness which were national characteristics. As in Holland, everything was kept spotlessly clean. One observer reported that even in visiting hovels in cellars in which people lived after bombing attacks, they kept these places clean. This goes far to explain the absence of extensive outbreaks of typhus or other similar epidemic diseases in which a lack of body cleanliness plays a considerable part.

This immunity from epidemics and serious losses of population from disease would probably not have continued had the war been

much prolonged beyond VE-day. The destruction of medical schools and hospitals and particularly the loss of medical and hospital supplies, drugs, surgical dressings and instruments, together with the almost complete breakdown of transportation certainly would have led to an almost total lack of medical care.



THE UNITED STATES NAVAL MEDICAL SCHOOL

The first published recommendation in English for a school of graduate instruction in naval medicine was made by an English naval surgeon, John Atkins, in 1732, the year, incidentally, of George Washington's birth. In 1823, Dr. Thomas Harris of the United States Navy, afterwards the second Chief of the Bureau of Medicine and Surgery, established a school of instruction for newly appointed naval surgeons at Philadelphia and maintained it for nearly 20 years. In 1893 the Naval Laboratory was used as a school but it was not until 1902 that the present Naval Medical School was officially established and regular classes ordered to it.

The Naval Medical School is a remarkable institution in many ways. It was the first school of naval medicine established in the New World and is still the only one in North America. Furthermore, it was, with the Army Medical School, the pioneer in the teaching of tropical medicine in the United States. From the Naval Medical School a large number of naval medical officers, trained by such leaders in tropical medicine as Stitt, Butler, Mink, and others, did work in the control of tropical diseases in Nicaragua, Panama, Cuba, Haiti, the Dominican Republic, the Virgin Islands, Guam, Samoa, and the Philippines which had world-wide significance and effects. The prestige conferred upon the Medical Corps of the Navy by this work was considerable and the United States Navy can be justifiably proud of the position of the Naval Medical School as a pioneer teaching institution in this important field.

As the first school of naval medicine in the Americas, the Naval Medical School did much to bring about recognition of naval medicine as a specialty comparable to other medical specialties. As in tropical medicine, the school was the center for the teaching of naval hygiene and related subjects. Gatewood's textbook on Naval Hygiene as well as that of Pryor were widely used, not only in our Navy, but in the navies of many other countries as well, and the influence of the school on naval medicine has been far reaching and of the greatest value.



BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,

Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

HOSPITAL CARE OF THE SURGICAL PATIENT, A Surgeon's Handbook with an Appendix on the Treatment of Wounds, by George Crile, Jr., M. D. Surgeon, Cleveland Clinic, and Franklin L. Shively, Jr., M. D. Assistant Surgeon, Cleveland Clinic. Foreword by Evarts A. Graham, M. D., Bizby Professor of Surgery, Washington University School of Medicine, Saint Louis. 2d edition, 288 pages, illustrated. Charles C Thomas, Springfield, Ill., publisher, 1945. Price \$3.50.

With the return of the medical veteran to civilian status, interest in hospital residence services has assumed considerable importance. The zeal with which the young physician is fired to carry on his medical education and training is a commentary on the foresightedness of the planners of medical education. The demand for more training has placed a premium on hospital residence. With the acceptance of the duties and obligations which these services impose upon hospital attendants comes a certain amount of timidity, especially where one has been accustomed to military field technique. For this reason alone, Crile's and Shively's book on "Hospital Care of the Surgical Patient" will prove a valuable asset in smoothing over the transition from military to hospital life. It gives in succinct language the routine standardized technical therapeutic procedures consistent with recent advances in physiology and chemotherapy. It goes into detail regarding these procedures, giving their rational background, which may have become obscured during the recent accelerated training program. The emphasis on parenteral medication is well taken, indicating that there are many useful medicaments valuable to the postoperative patients over and above intravenous saline or dextrose.

The book does not presume to meet with every expediency. It specifically states that some of the routine measures given may be impractical in other than Crile's institution. However, those that are given may be relied upon as acceptable, well-tried, and approved.

For these reasons, this book is highly recommended, particularly for interns and residents. The busy practitioner, on the other hand, will read the pages with considerable benefit to himself and his patients. The fact that the first edition has been exhausted so soon, is a testimony of the value of this work.

FAMILIAL NONREAGINIC FOOD-ALLERGY, by *Arthur F. Coca, M. D., Medical Director, Lederle Laboratories*. 2d edition. 185 pages. Charles C Thomas, Springfield, Ill., publisher, 1945. Price \$3.75.

For many years, the author of this monograph has been an authority in the field of allergy. Although the statements in his book are startling; nevertheless, because of his pre-eminence, he deserves a nonpartisan audience.

In the second edition of his book, the author revises and enlarges his original thesis of familial nonreaginic food (idioblaptic) allergy. He comes to conclusions that are, in the main, somewhat at variance with current medical dogma. Those are (1) the level and range of the normal pulse rate is a physiological constant in each individual, but widely varying in different individuals; (2) the most common cause of variations in the individual from the normal constant is idioblapsis; (3) upwards of 80 percent of the white population are hereditarily affected with idioblaptic allergy; and (4) idioblapsis is probably of a lethal character, the most important cause of noninfectious diseases, and a predisposing cause of some infectious diseases. In addition, the following assertions are made: (1) All subjects with dementia praecox thus far studied exhibited the typical idioblaptic pulse; (2) all 297 persons with malignant disease of the breast presented symptoms of idioblaptic allergy; (3) essential hypertension and epilepsy may have an idioblaptic etiology. In a word, Doctor Coca feels that familial nonreaginic food allergy is of far-reaching significance.

As the author states in the preface, there is considerable skepticism regarding those tenets among allergists. Whether the medical profession can accept the statements depends upon much further investigation. At least, the author's work should be confirmed or disproved by other qualified investigators before any conclusions be reached regarding the truth or falsity of the assertions. If the claims are correct, the amount of suffering that can be relieved is incalculable. Those physicians interested in allergy and related subjects should be familiar with the contents of this work.

PREVENTION, FIRST AID AND EMERGENCIES, by *Lyla M. Olson, R. N., Superintendent of Nurses, Kahler Hospital, Rochester, Minn., with additional contributors.* 591 pages, 190 illustrations (line cuts). W. B. Saunders Co., Philadelphia, Pa., publishers, 1946. Price \$3.

This book on first aid is one of the most complete published in this country. Usually such books are rather small and limited to a few fields. This is not the case, however, with Miss Olson's book and it contains many features that are original and important for works of this character. One for example, is a particularly excellent chapter on common accidents with emphasis on the prevention of them. Another excellent chapter is on poisons and their antidotes. This includes a good section on poisonous plants with numerous illustrations. There are many tables including a table of vitamins; a table with the various types of bandages and their uses; and one showing the communicable diseases. There is a good table and very excellent suggestions on the removal of stains. Some of the old fallacies are repeated in the section on resuscitation but this is almost the only criticism of a very excellent book.

TEXTBOOK OF PEDIATRICS, edited by *Waldo E. Nelson, M. D., Professor of Pediatrics, Temple University School of Medicine, Philadelphia, with the collaboration of 49 contributors.* 1,350 pages; 519 illustrations on 333 figures, 26 in color. 4th edition, revised. W. B. Saunders Co., Philadelphia, Pa., publishers, 1945. Price \$10.

The new Mitchell-Nelson Textbook of Pediatrics is an outstanding achievement. Waldo Nelson, professor of pediatrics at Temple University School of Medicine and formerly closely associated with the late A. Graeme Mitchell at Cincinnati, accepted the editorship of the fourth edition of the single-volume textbook, previously called Grif-fith and Mitchell.

As is the present custom, there are numerous collaborators, 49 authorities on various subjects with the editor-in-chief (Nelson) contributing many of the sections and shaping the material into a unified work. Therefore, it is really a "new" book, which upholds the fine tradition of the previous editors.

This book, while not too complicated for the medical student of today, is admirably suited to the needs of the pediatrician and the general practitioner who wants up-to-date, detailed information, without going through the more extensive "System of Pediatrics." The reviewer highly recommends the book.

THE 1945 YEAR BOOK OF INDUSTRIAL AND ORTHOPEDIC SURGERY, edited by *Charles F. Painter, M. D., Orthopedic Surgeon to the Massachusetts Women's Hospital and Beth Israel Hospital, Boston.* 432 pages, illustrated. The Year Book Publishers, Inc., Chicago, Ill. Price \$3.

This pocket sized book, as in the past years, contains a wealth of important up-to-date material that no busy industrial or orthopedic surgeon can afford to overlook.

Osteo-arthritis as an orthopedic problem is discussed with the importance of the disturbances of proper weight-gearing, the building up of muscles and the common mistakes of handling patients with arthritis and allied conditions. The increasing value of gold therapy and the failure of penicillin in arthritis is reviewed. The chapter on osteomyelitis and its treatment with penicillin should be read by everyone dealing with this condition. Poliomyelitis with the evaluating of results of treatment is interestingly considered. There is a chapter on bone tumors and cysts with mention of the increasing satisfaction of aspiration biopsy. Fractures and dislocations are brought up to date and the author discusses the changes in fashion in the manner of treatment. Refrigeration anesthesia with a simple technique is concisely described as is the operative technique in various orthopedic procedures.

The section on industrial medicine and surgery stresses the necessity of training medical students in this specialty and emphasizes the increasing importance of industrial medicine and surgery in industry.

The Year Book is invaluable to busy surgeons as an aid in keeping up to date in industrial and orthopedic surgery.

HEALTH CARE OF THE FAMILY, by *Ramona L. Todd, Ph.D., M. D., Physician in the Students' Health Service and Assistant Professor in the School of Public Health, University of Minnesota*, and *Ruth B. Freeman, R. N., M. A., Associate Professor and Director of the Course in Public Health Nursing in the School of Public Health, University of Minnesota*. 530 pages, illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1946. Price \$3.

This book, designed primarily to meet the need of college students as a reference and textbook on family-health conservation, also should fill the need of homemakers who wish authoritative information on the problems of child care and family life.

Doctor Todd and Miss Freeman have included every aspect of the subject, covering home environment, safety measures, child care, and home nursing, as well as attitudes and adjustments necessary for fullest happiness in family and married life. The material, well classified and indexed for reference, is presented in discussion form, readily understandable to the layman as well as to the student having a foundation in medical, nursing, or social studies.

Nothing apparently has been omitted which could contribute in any way to family well-being. The chapters on "Home Care in Illness" are especially good, well-illustrated, and arranged so as to be readily accessible as text material for home-nursing classes or for the use of the lay person charged with nursing care in the home.

In the opinion of the reviewer this book might well be prerequisite reading for all homemakers as well as for students of public health and social relationships.

The chapters on marriage relations, normal sex life and development, prenatal care, principles of disease prevention, and aspects of childhood behavior seem worthy of special mention.

A SURGEON LOOKS AT LIFE, by *Richard A. Leonardo, M. D., Ch. M., F. I. C. S.* 128 pages. Froben Press, Inc., New York, N. Y., publishers, 1945. Price \$2.

The title of this interesting and informative little volume adequately describes the contents. Differing from textbooks and scientific treatises, the author gives his philosophy of life, and in so doing discusses such topics as the Churchman and the Doctor, Euthanasia, Juvenile Delinquency, and Life After Death.

Medical students and interns will find much that is worthy of thought in the pages of this book, as it deals principally with the intangibles and imponderables of the practice of medicine.

CLINICAL APPLICATION OF THE RORSCHACH TEST, by *Ruth Bochner, M. A., Psychologist, formerly Bellevue, Psychiatric Hospital, and Florence Halpers, M. A., Psychologist, Bellevue Psychiatric Hospital, New York.* 2d edition, revised and enlarged; 340 pages. Grune & Stratton, New York, publishers, 1945. Price \$4.

This is another of a number of recent books on the clinical use of Rorschach's Projective Test. Approximately the first fifth of this book restates in a general way the bases for scoring and clinically interpreting the responses given by subjects to the 10 Rorschach ink blots. Chapters 10 to 17 are devoted to a presentation and an analysis of 40 tests. These have been given to subjects who presumably represent typical personality patterns met within clinical practice.

There has been established since 1922 a considerable body of data on the clinical applications of the Rorschach Test and the Test's usefulness in personality appraisal. One gets the impression that the authors of this book, in their attempt to be clinically helpful, resort to rather rigid formulae in support of empty and rather arbitrary statements.

STRUCTURE AND FUNCTION OF THE HUMAN BODY, by *Ralph N. Baillif, Ph. D., Assistant Professor of Anatomy, Louisiana State University School of Medicine, New Orleans, and Donald L. Kimmel, Ph. D., Associate Professor of Anatomy, Temple University School of Medicine, Phila.* 328 pages, 158 original illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers. Price \$3.

It might seem presumptuous and superfluous to present a new textbook of anatomy. The authors justify this 328 page volume by contending that most texts are too voluminous for efficient use in the time usually allotted to an introductory course. Whether this is pertinent to the anatomic course requirements of a medical student, as applied to Gray, to Pierson, to Cunningham, or to Morris, is questionable, but it may well be true when the average science student is considered.

However the result is a very convincing volume, which should be destined to make a place for itself in the training of those needing anatomic and physiologic groundwork short of that for a medical career. It's concise and accurate, and simply written. Its illustrations are not copied from the older textbooks, but are largely originals prepared by W. Branks Stewart, medical artist for Louisiana State University School of Medicine.

AVIATION NEURO-PSYCHIATRY, by *R. N. Ironside, M. B. (Aberd.), F. R. C. P. (Lond.) Consultant in Neuro-Psychiatry to the R. A. F. (overseas), Neurologist, West London Hospital, Assistant Physician, Hospital for Nervous Diseases, Maida Vale, and I. R. C. Batchelor, M. B. (Edin.) Medical Officer in Charge of a Neuro-Psychiatric Division in a R. A. F. General Hospital (overseas).* 168 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1945. Price \$3.

This small but readable volume by two English psychiatrists gives a general picture of the problems most likely to confront the practitioners of that specialty who are assigned to work with aircrews.

The book is divided into three parts. Part I is entitled "Flying and the Normal Individual," and under this heading are discussed (1) The Aviator and his Environment; (2) Selection for Flying; and (3) Flying Confidence.

Part I consists of only 17 pages, and one is struck by the difference in British and American selection methods. The authors state, "Special aptitude tests based on attempts to reproduce flying conditions on the ground do not, in our opinion, form a necessary part of the selection technique." They refer particularly to machinery conducted to test eye and hand coordination in action. They further state that while these tests can be used to detect some of the accident prone, most of these individuals would be eliminated if the temperamentally unstable and those with a history of repeated accidents on the ground were eliminated at interview. In view of these statements, and considering the excellent record made by the RAF fliers, it would seem extremely important to compare British and American statistics regarding rejection rates and incidence of mental and emotional illness in fliers. Unfortunately, the conditions under which the authors wrote precluded the possibility of giving any breakdown of statistics.

Part II is concerned with the neuropsychiatric examination of prospective candidates for flying and is noted for its simplicity.

Part III considers the neuropsychiatric disorders in aviators, and makes up the largest part of the book. In addition to discussing the etiology, symptoms and prophylaxis of neurotic reaction, a number of case histories are given. Sickness in the air, Neurotic visual disorders, Migraine, Head injuries and Disturbances of consciousness in the air also came in for discussion.

The book suffers somewhat from lack of references, but this was due to conditions under which it was written. This difficulty is counter-balanced however, by the practicality and simplicity of the work, and it is made valid by the personal experience of the authors.



ELECTROENCEPHALOGRAPHIC STUDIES IN DIABETES MELLITUS

Diabetic patients in general do not suffer from epileptic phenomena more than do members of a normal group. In clinics in which large groups of diabetic patients are studied, however, a small but nevertheless significant fraction of cases presents extreme difficulty in control by routine methods, and requires special attention. These patients are inordinately sensitive to relatively minor changes in the blood-sugar level, and their clinical reactions are disproportionately severe. The manifestations of insulin sensitivity are highly variable.

In cases of this kind it is of both theoretical and practical importance to know what role the nervous mechanism plays in the fundamental instability. Because the changes primarily involve carbohydrates, the chief foodstuff of the brain, one is naturally inclined to suspect disordered function within the central nervous system. From the clinical point of view, many of the reactions involve abnormal but co-ordinated motor manifestations or specifically suggest epilepsy. Other reaction patterns, such as unconsciousness, point incontrovertibly to abnormal cerebral function.

The electroencephalographic evidence supports the theory that severe repeated insulin reactions are due not only to unstable carbohydrate regulation but also to unstable cerebral, and specifically cortical, function as well. Some of the electroencephalograms obtained were indistinguishable from interval patterns in patients suffering from grand-mal epilepsy. The incidence of abnormal or atypical brain wave-tracings in the unstable group of diabetic patients is too high to be due merely to chance.

The observations established the fact that the central nervous system plays a leading role in the instability of patients with so-called "problem diabetes" or diabetes regulated with great difficulty. In this group the possibility of cortical instability should never be neglected in evaluating the functional difficulties of the patient, and by implication, proper treatment should encompass proper management of the central-nervous-system disorder. The electroencephalogram may be invoked as a valuable aid in studying diabetic patients with frequent severe insulin reactions.

GREENBLATT, M., MURRAY, J., and ROOT, H. F.: Electroencephalographic studies in diabetes mellitus. *New England J. Med.* 234: 119-121, January 24, 1946.

PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge

RODENT CONTROL, U. S. NAVY, PACIFIC OCEAN AREAS, WORLD WAR II

THOMAS B. MURRAY

Lieutenant Commander H (S) U. S. N. R.

PREVIEW

At the outset of the war it was common knowledge that rodents were prevalent on all Pacific islands and adjacent continental areas. Bubonic plague and other rodent-borne diseases affecting man were known to occur sporadically throughout the area. Rodent damage to matériel stores was widespread and of sufficient volume to require control.

Requests were made by shore stations and ships to the Bureau of Medicine and Surgery for assistance in controlling rodents. Officers with experience in the rodent-control field practices in the continental United States, were recruited, mainly from the Fish and Wildlife Service, U. S. Department of the Interior. These officers were given a short course of training in malariology and naval procedures at the U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md.

Following this training, officers were assigned to naval districts on the West Coast of the United States and to naval commands in the Pacific. A brief description of the duties assigned and work done by rodent-control officers is appended to this report.

RODENT SPECIES

Available descriptions and classifications of rodents in the Pacific at the beginning of the war, were generally based on localized collections. No attempt had been made to group the common species of rats, mice, and shrews. For the purpose of this discussion and for simplification of outlining control operations, the rats have been placed in four groups, mice in one group, and shrews in one group.

Alexandrine-type rats (tree rats).—The common rat in the Pacific is brown on back and along sides, with many variations of color on the belly and neck from blue to white. The body contour is generally long and angular and of medium size. Ears are large, tail is small in diameter and as long or slightly longer than body. Feet are comparatively long and narrow and fitted for climbing. There are as many variables in color as there are localities in which this rat is found. There may be many subspecies, but from the standpoint of general body conformation, food habits, cover types, and general over-all behavior, there is but one type of medium-sized brown rat found throughout the Pacific Ocean area islands. This type is common on all inhabited areas. It does not burrow in the ground and will be found nesting in trees, buildings, rock crevices, caves, and holes that are dry and protected from weather, matériel dumps, and occasionally in grass mounds or clumps. It is essentially a tree rat and a seed or vegetable eater, but is very adaptable and omnivorous in feeding habits. It includes marine forms along the seashore and many items intended for human consumption in its diet. It thrives best in the fringes of native type replacement cover or in the vicinity of cultivated trees and shrubs and cane fields. Production of cocoanut groves or plantations furnishes ideal food and habitat conditions for this rat. It is seldom found in true climax-type forests except along outer fringes.

In addition to the Alexandrine type proper, there occur frequently within the limits of the range under consideration at least two closely related types. The *mindanensis* or Philippine type is found throughout the Marianas, Caroline, and Philippine islands. The *flavipectus* type occurs in the Bonin, Ryukyu (Okinawa), and adjacent islands. Still another type of rat (probably belonging to the *diardii-neglectus* section of the genus *Rattus*) may occur in the Admiralty Islands. The black, Alexandrine, and white-bellied types of rats occur in the Hawaiian islands along with the Norway rats, and the same is probably true in the Marshall, Gilbert, Solomon, and Samoa islands.

Polynesian- or exulans-type rats.—This diminutive-type rat, of which there may be many local subspecies, is generally dark brown on back and along sides with bluish underparts. Over-all length of body and tail does not exceed 300 mm. The adults of this species are oftentimes confused with the immature forms of the common brown Pacific rat. It is generally localized in habitat and is what may be regarded as a prairie or open dry grasslands-type rat. Shrubs or low-growing trees interspersed with coarse and/or fine grasses supply suitable habitat. They do not appear to be capable of wide adaptation in feeding habits and show rapid fluctuations in numbers. They may become

unusually numerous under favorable habitat conditions. They infest buildings and matériel dumps and become very troublesome in pineapple fields, grasslands, and cane fields. These rats may burrow in loose soil to some extent but are not regarded as a burrowing rat. Their range is limited to the hot humid areas of the south central and western Pacific and Asia. No specimens have been reported from islands north of Guam, including Okinawa.

Norway-type rats.—Soil, climate, and typical native habitat is not conducive to the propagation of Norway-type rats on the Pacific islands.

Where seaport towns have been established with wharves, docks, warehouses, basements, matériel storages, and drainage structures, the Norway-type rats have become established in considerable numbers. These rats resemble the typical North-American type Norway in shape, size, and essential body features, viz, short, heavy tail, large feet, and generally short ears. The body coloration is generally silvery-gray or a light grayish-brown on back and sides with lighter colored under parts. The Pacific island phase of the Norway-type rat is definitely lighter colored and slightly smaller than the North American phase. There is an exception to this in the Philippine-type Norway rat found at Tacloban and Tolosa on Leyte and in the Manila-Bay area on Luzon. In these localities the coloration is generally a "Norway brown" with a very considerable percentage of black with white markings on throat and belly. This black phase of the Norway is typical of these two areas and unusual for this species.

These rats are very much a pest in the areas named but do not become readily established in the stilt-type native bamboo villages in the Philippine Islands. They move into military camps and matériel dumps as these are established in infested areas.

The light-colored phase of the Norway type is encountered on Saipan, Iwo Jima, and Okinawa. On these islands this species of rat is fairly common and must be given consideration in control operations. In the South Pacific the main Norway infestations are centered on New Caledonia. Moderate infestations of Norway rats occur on main Hawaiian Islands. Some infestations have been reported in the Samoan area.

Jungle- or forest-type rats.—In the Philippine Islands and New Guinea several species of jungle- or forest-type rats occur. For the most part they are generally large in size, light to dark brown in color with long guard hairs which present a rough grizzly appearance. They are usually encountered in areas where climax-type forest growth occurs. Where this type of vegetative growth has been recently removed, or along fringes where the forest is still intact, it is not uncommon to find these forest-type rats overlapping the areas occupied

by the domestic-type rats. Where native villages and military camps are located entirely within the bounds of primeval or climax-type forest areas, the forest-type rats may become a pest.

House mice.—One or more species of house mice are prevalent throughout the Pacific. The coloration is generally blue-gray to dark brown and the size is slightly smaller than the North American house mice. They tend to become a pest in living quarters, warehouses, and matériel dumps that afford suitable food and cover conditions.

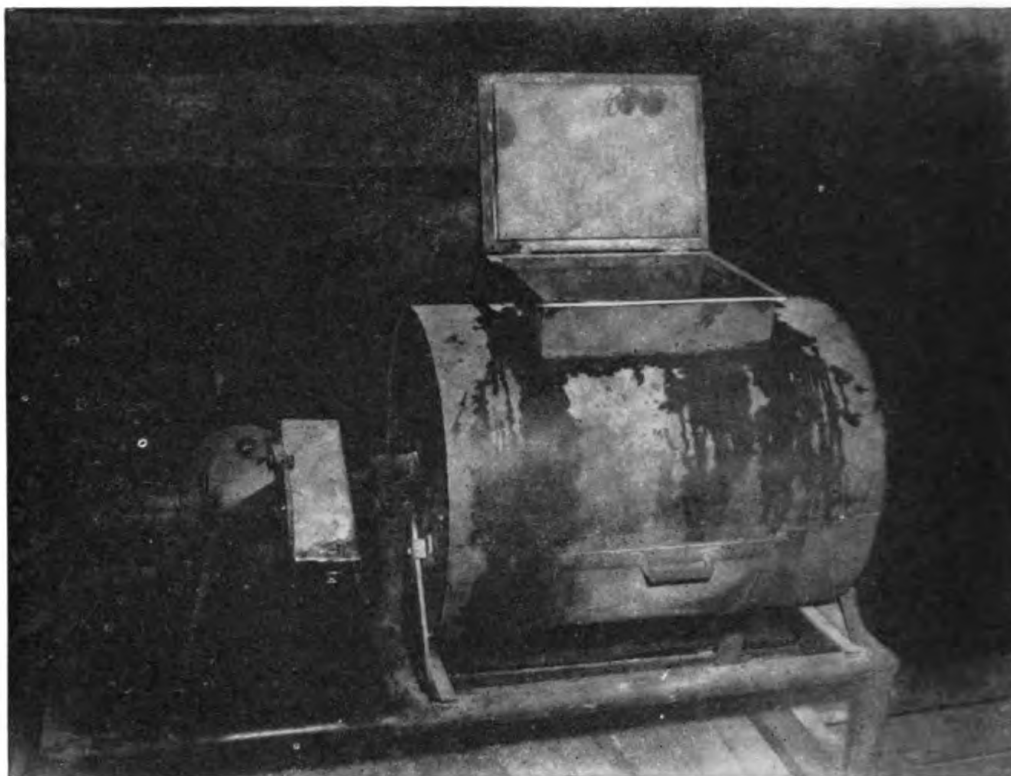
Shrews.—In the Philippine Islands and Okinawa area, two or more species of shrews are prevalent. The typical color is a deep gunpowder blue or slaty blue-black for all species. The larger species is comparable to the Eastern pine mice or large Western field mice in size. The smaller species resembles house mice in size. All species of shrews have the long snout and long tail, distinctive of the shrews and lemmings. They live mainly in earth terraces, embankments and mounds, around water catchments, moist areas, and rock walls overgrown with weeds and shrubs. Where living quarters and storage areas are located alongside suitable habitat, shrews tend to become pests. They harbor ticks, mites, and fleas as ectoparasites.

CONTROL METHODS AND MATERIALS

Diversity of habits and habitat of rodents in the Pacific called for control measures that would be simple and yet effective. Methods of control as used in continental United States were not applicable for the indigenous Pacific species. Heavy rainfall, high humidity and temperatures would leach and sour baits of customary type and placement. Tree rats would not feed consistently on wet baits. Neither would they feed on any one of a variety of baits until some form of prebaiting was used to accustom these rats to eating a prepared bait. This applied generally to all Pacific rodents.

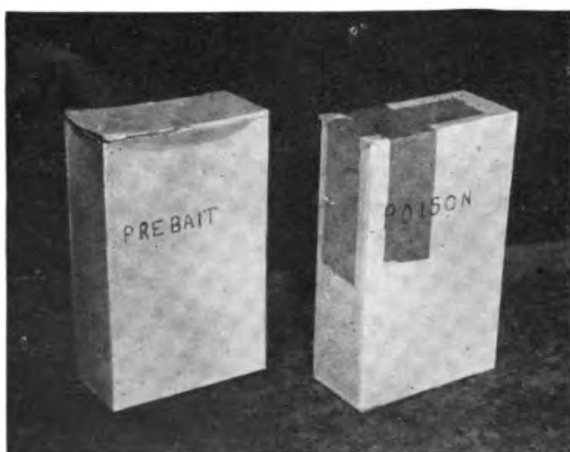
Prebaiting rodents, principally rats, for a period of 5 to 7 days with unpoisoned bait, followed immediately with poisoned bait exposed for 3 days in feeding stations, was found to be the most effective method. Feeder stations consisted of a feeder dish and a rainproof cover to protect bait and give the rodent a dry and protected place in which to feed. Feeder dishes and covers were generally made out of used tin cans. Sheet metal was an extra priority item for construction use only.

The most acceptable and readily available bait material was issue breakfast rolled oats. To make the oats more attractive, exclude suspended moisture, and serve as a spreader or carrier for poisons, it was necessary to add vegetable oil. This was done by adding any good grade of vegetable oil at the rate of 1 gallon of oil to each 100 pounds of bait material. Corn oil was the most acceptable vegetable oil for use as an attractant and vehicle for carrying poisons.



1. Power bait-mixing machine built by Twenty-third Construction Battalion, Guam, which worked very satisfactorily for preparing prebait and poison bait.

Baits were prepared by means of a shovel or paddle and suitable container, or with specially built mechanical mixers. Prepared prebaits and poisoned baits were put up in convenient-sized packages. Empty oatmeal containers were used for this purpose. Containers



2. Prebait and poison bait put in empty oatmeal cartons, and properly labeled; ready for delivery to military units. Cartons containing poison bait sealed with tape.

were properly sealed and labeled and stored for distribution to military and civilian units. Care was taken to prepare and package prebaits and poisoned baits in proper proportions from each lot of materials to insure uniformity of acceptance. All prebaits and poisoned baits were prepared and packaged at a central point and held in readiness for pick-up on call by military and civilian units or for shipment by air or surface to outlying stations.

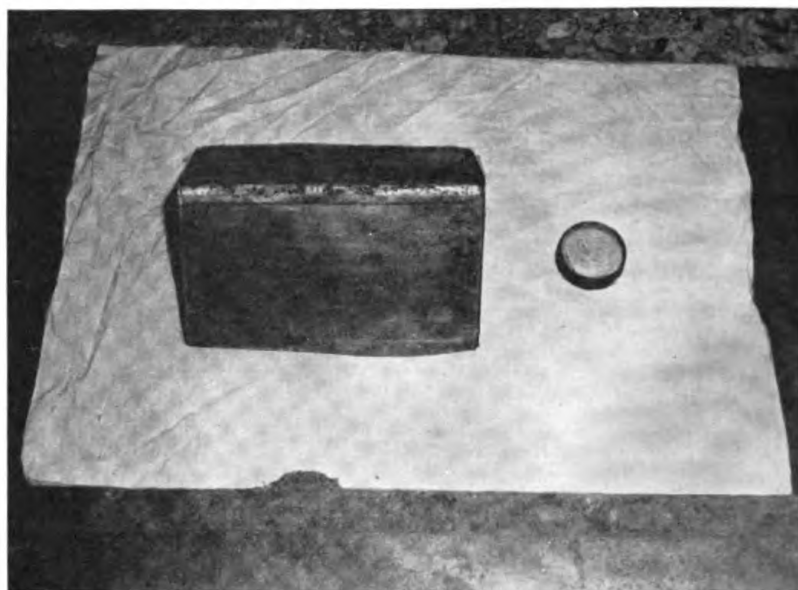
In the early stages of control operations the only available poisons were barium carbonate and red squill. Percentage kills with either of these poisons was always relatively low, usually less than 50 percent, which, from a control standpoint is very unsatisfactory. A definite aversion for any type bait was built up in the resident rat populations following the use of either of these poisons.

Beginning in the last half of 1944 a supply of zinc phosphide and thallium sulfate was purchased by Army and Navy supply sections and by the end of the year some shipments were being received at forward area stations. A limited supply of these poisons was obtained at Honolulu in December 1944 for use in the Hawaiian and Marianas Islands. By the end of 1945, a plentiful supply was on hand at main naval stations in the Pacific. Shipments of "1080," sodium-fluoroacetate, were received for the purpose of checking this material as a rodenticide for use on Pacific rats. Thallium-sulfate baits were readily eaten by all rodent species. Excellent results were reported wherever this poison was used. Zinc phosphide was variable in rate of acceptance and percentage kill. During dry seasons and periods of low humidity the acceptance and results were good. In wet seasons and times of high humidity the zinc phosphide baits would absorb moisture, producing a soggy, damp, unpalatable bait, as well as liberating the active killing properties in the zinc phosphide. The use of stabilizing agents, chalk, lime, etc., was said to overcome this objectionable feature. To make this poison usable and satisfactory, throughout the Pacific or in any hot, humid, and wet climate, it must be stabilized by the addition of lime, chalk, or the use of a spreader that will keep it stable under all conditions.

Sodium-fluoroacetate ("1080"), a rodenticide developed during war-time, was tested and used somewhat extensively in Pacific Ocean areas. Tests demonstrated that this material was highly hygroscopic and would have to be used as a water-soluble, or combined with a stable-bodied spreader that would hold it in suspension or in combination with bait materials.

Careful check-up with caged rats demonstrated the presence of a taste or repellent factor. Extensive field tests verified this observation. No determination could be made as to the type of masking agent or stable spreader that might overcome objectionable features. This rodenticide is not considered to be foolproof until it can be stabilized and held constant in other than water-soluble solutions or mixtures.

Results with "1080" were spectacular in immediate knockdown or sight kill of rats. On field tests it was very easy to locate dead rats close to bait spots or feeder stations. The high degree of toxicity and lack of a suitable human antidote would tend to preclude the use of "1080" by other than experienced personnel.



3. Bait-station cover made out of one-half of 5-gallon can. Feeder dish holding prebait and poison bait.



4. Bait station cover made from No. 10 cans and scrap lumber. Feeder dish made from small-sized cans, beer, milk, or C-ration cans.

No effort was made to color baits to serve as a warning agent or repellent. Practically all baits were exposed in feeder stations which excluded birds and other wildlife species.

RODENT CONTROL ORGANIZATION AND WORK PROGRAM

Military commands in forward positions were usually set up on an area or island command basis. Rodent-control officers were attached to the medical office and held responsible for supervision of rodent work in all military and civilian units within the area.

In each military and civilian unit the sanitation officer was held responsible for detailing hospital corpsmen, enlisted men, and laborers to place prebait, poisoned bait, and traps. These men were given a course of instruction by an area or island rodent-control officer. This officer made periodic check-ups on all units to assure compliance with orders requiring each unit to do its own rodent-control work.

A uniform plan of work was adhered to in the forward areas. Each unit would make up feeder dishes by cutting small-sized milk, beer, or "C" ration cans to 1 inch in height to hold approximately 1 ounce of bait. Feeder-station covers were made from used 5-gallon and No. 10 tin cans, tin bomb covers, or scrap lumber. These covers would average 12 inches in length by 8 inches in width and 7 inches in height.

The feeder dishes and feeder-station covers were paired and placed on a systematic basis, spaced at 100-foot intervals throughout the military area or native village and in the periphery to a depth of 300 feet. This would simulate a blanket coverage and assure that every rodent within the camp or native village and the peripheral areas would come in contact with a feeder station. The process of placing feeder stations, prebaits, poisoned bait, and taking up feeder stations and left-over poisoned baits, required an 8- to 10-day period. A 2- or a 4-man crew was usually detailed to do the work in each camp or village. This operation was repeated at intervals of 60 to 90 days, depending on the thoroughness of cleanup of rodent populations and the rate of reinfestation from outside areas. Periodic and blanket treatment was stressed to fit rodent population trends and obviate the building up of a resident poison-wise or control-wise rodent population. The use of traps or any



7. Bait-station covers painted, labeled, and numbered for easy identification. (Fleet Hospital No. 115, Guam.)



6. Bait-station cover and feeder dish, showing placement in "marginal" cover where rats are usually most abundant.



7. Live trap made by Construction Battalion out of Spam can. Treadle inside trips trap door. Very good type live trap. Guam.

specialized type of control devices was based on blanket periodic coverage. Rotation of baits and traps as to type and placement was initiated to assure acceptance and to fool the "wise ones." Special details of men, designated as rodent-control crews, were used to treat in-between areas on some portions of the islands to clean out focal points of rodent reinfestations.

Special emphasis was placed on clean-up and close-up of all inhabited areas to remove all food and cover for rodents. Cocoanut, bread-



8. Cocoanut trees in camp area "banded" with strips of tin to prevent rats from climbing trees to gain access to food and cover. Bands are wide and well placed.

fruit, or any large trees within military camps were banded with a strip of metal not less than 10 inches wide to prevent rats from climbing trees to find food and shelter. Good housekeeping was stressed first, last, and always.

SHIP-SHORE RAT CONTROL

Ship-shore rat-control measures were set up at principal ports of entry in all forward areas. Rat guards and other safety measures were used to prevent rats from coming ashore. Special emphasis was given to controlling rats in matériel dumps intended for shipment to new bases or other forward stations. It was observed that shipments of subsistence and general supplies coming from storage in



9. Coconut trees along "marginal" areas of Fleet Hospital No. 115. Trees have been "banded" to repel rats. Metal bands are more than 10 inches wide and over 6 feet above ground.

South Pacific areas to points in the Philippines, Marianas, and Okinawa Islands, showed evidence of rodent infestations. This was most noticeable where matériel had been palletted and reshipped without reshuffling of piles. Keeping rats out of stored matériel was the most effective means of controlling their movement from island to island and from ship to mainland.

FUMIGATION AND RAT CONTROL ABOARD SHIPS

Methods of trapping and poisoning rats aboard ships were demonstrated and applied by rodent-control officers at various ports. Poisons and traps were supplied from central supplies on request of ships' sanitation officers.

Incident to the lay-up of large numbers of PT boats in the vicinity of the naval base, Guiuan, Samar, P. I., a request was made for assistance in treating hulls with Cyanogas for controlling insects and rats. Rodent-control officers stationed at this point assisted in treating more than 60 boats.

BAIT FORMULAS

Special-type baits were developed through careful field trials and experimentation to overcome adverse climatic and natural-food con-

ditions. The recommended mixtures and formulas are listed herewith.

Oil-cereal baits.—Oatmeal, corn meal, or cereal mixtures should be used at the rate of 100 pounds of bait material to 1 gallon of oil. Corn oil (Mazola), cottonseed oil, cocoanut oil, and mineral oil is the recommended order of preference for use. Mineral oil is less acceptable than edible-type oils and should only be used when other oils are not available. Cocoanut oil is very acceptable when fresh but tends to become rancid under normal storage conditions.

Oil-peanut butter cereal baits.—Peanut butter in the large 8-pound-can size is mixed at the rate of 1 can (8 pounds) to 3 quarts of oil. This mixture is blended with 100 pounds of cereal-bait materials. The consistency of the oil-peanut butter mixture is such that it requires careful and thorough kneading and mixing to get an even coating of bait particles. The addition of peanut butter to bait makes for variety or change in make-up of oil-type baits and tends to increase acceptability of baits.

Oil-cocoanut cereal baits.—Ground or shredded copra (dried cocoanut), is added to cereal-bait material in the proportion of 20 pounds of ground copra to 80 pounds of cereal to make 100 pounds of bait. One or two quarts of oil, preferably cocoanut oil, should be added, depending on the amount of free oil in the copra. It is always desirable to add 2 quarts of oil to the mixture when preparing poisoned baits to assure an even distribution and adherence of poisons to bait particles.



11. Metal "bands" on tree. Poorly placed. Band is too narrow and close to ground, and on slanting tree. Rats could climb this tree.

Fresh cocoanut, ground or shredded, can be used in the same proportions and manner. Baits prepared with fresh cocoanut will not keep in storage but must be used immediately.

Oil-fish cereal baits.—Canned salmon, tuna fish, or mackerel should be broken up in finely-divided particles and added to vegetable or mineral oil at the rate of 4 to 6 pounds of any one variety of fish to each gallon of oil and 100 pounds of cereal-bait materials. This type of bait will not keep in storage and should be used soon after mixing.

Rolled oats is the most acceptable type of cereal-bait material. Corn meal and mixed ground cereals (Cream of Wheat, whole wheat, and farina mixtures) are less acceptable.

In preparing any type of oil-cereal baits, the poison should be blended with the oil or sifted slowly and evenly over the bait material after the oil has been added. Thorough and complete mixing of all components is very necessary to assure an even distribution of the rodenticide throughout the bait.

RODENTICIDES

Thallium sulfate is a dense white powder, tasteless and odorless, and is the poison of choice for good results. It should be used at the rate of 1.5 to 2 percent in all oil-cereal type bait. Bulky or coarse-type material requires slightly more poison.



11. Drying cocoanuts for use in making prebait and poison bait.

Zinc phosphide is a finely ground black, powder-like material and has a distinctive pungent, garlic-like smell. It should be used at the rate of 1.5 to 2 percent in all oil-cereal type baits. Use the larger amount with bulky, coarse-bait material. Zinc phosphide should be used in dry weather for best results.

Sodium fluoroacetate ("1080") is a light-weight, white powder. Due to its hygroscopic qualities, it should be mixed with the oil and then combined with the bait materials. It should be used at the rate of 4 ounces to each 100 pounds of cereal-type bait materials.

Red squill is a reddish-brown powder with a slight acrid odor. It should be used at the rate of 8 pounds to each 100 pounds of cereal-type bait material. It is necessary to use 2 to 4 additional quarts of oil in preparing baits with red squill to get an even distribution of poison. Due to low toxicity, this bait is not recommended for use on naval areas except where children and domestic pets are present or special precautions must be taken to protect native laborers.

Arsenicals are not recommended for use as rodenticides. *Strychnine* can be used to control house mice, but other rodenticides listed, excepting red squill, will serve the purpose. *Antu* will kill rats but is generally no more effective than red squill and is not recommended for general use.

Syrups, sugars, or water-base spreaders tend to break down in damp or wet weather. Baits prepared with this type of spreaders tend to mold and become unacceptable due to absorption of moisture and change in texture and taste. They are not recommended for use in the Pacific Ocean area.

All oil-cereal type baits should be packaged immediately after mixing. Packages should be airtight and dust proof. Storage space should be dry and cool.

CUBED COCOANUT BAITS

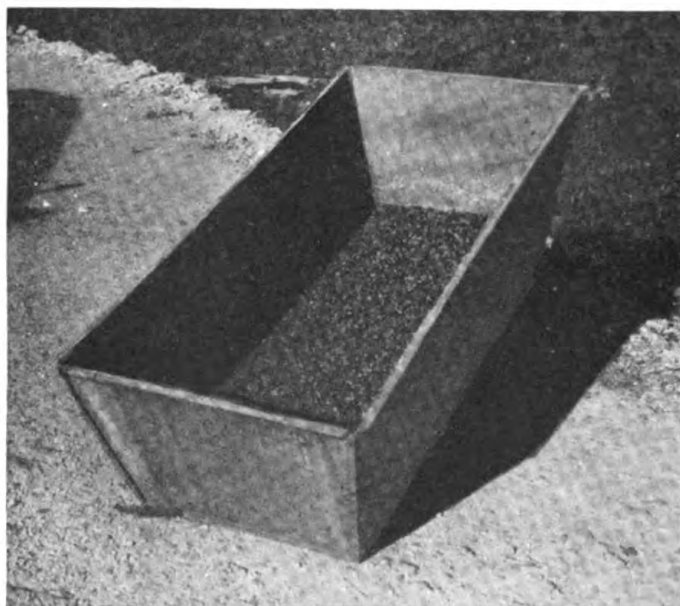
Dried copra is cut into $\frac{1}{4}$ - to $\frac{1}{2}$ -inch cubes and placed in a tub or mixing vat. One ounce of "1080" is dissolved in 1 gallon of cold water. This gallon of poison solution is added to 25 pounds of cut cocoanut cubes and allowed to stand for 12 to 24 hours until all of the moisture is absorbed. The cubes should be stirred at regular intervals to insure even distribution of poison. The cubes should then be spread on a screen or clean surface to dry.

The cubed-cocoanut bait can be used to broadcast along marginal brushlands, rocky, broken spots, or grasslands, at the rate of 2 pounds per acre. This method is not recommended except for use on areas where a quick, partial clean-up of rodents is desired and where there is no danger to humans, domestic livestock, and pets. In areas where cocoanuts are plentiful and rodents have been accustomed to eating cocoanuts this type of bait should be generally acceptable.

RODENT-BORNE DISEASES, PACIFIC OCEAN AREA

Authenticated cases of rodent-borne diseases were reported as affecting military personnel and civilian personnel quartered in occupied areas. A brief outline of reported occurrence and cases is listed.

Bubonic plague.—The port of Noumea, New Caledonia, had a plague history. In an adjacent village, where smelter workers were housed, it was necessary to employ a full-time company-paid civilian



12. Coconut cut in $\frac{1}{4}$ -inch cubes and immersed in solution of "1080" and water. One ounce "1080" in 5 pounds water to 15 pounds cubed coconut.

crew to control rats.

This crew worked under naval supervision. Plague had occurred among civilian workers concurrent with our occupation; no cases were reported in military personnel.

In the Manila area, Philippine Islands, plague had been prevalent during Spanish and American occupation. No information was available as to the situation during the Japa-

nese occupation. Check-up showed a fairly low flea index, and no definite plague foci presently existing in the Manila area. Systematic rodent control was initiated on military areas to reduce hazards from any rodent-borne diseases.

Scrub typhus.—At Cape Glouster and other points in the South Pacific, outbreaks of scrub typhus were definitely linked with rodent infestations.

Coincident with invasion of the southern tip of the island of Samar, an epidemic of scrub typhus occurred in military personnel. Focal point of infestation appeared to be southeast and north of the town of Guiuan. Naval Medical Research Unit No. 2 demonstrated the presence of the mite vector. These mites occurred in large numbers in areas heavily infested with rodents. The rodents were controlled on a large area with a definite reduction in prevalence of scrub typhus.

Epidemiology Unit No. 61, stationed at the United States Naval Station, Guiuan, Samar, P. I., demonstrated that rats carried scrub-

typhus virus in the blood stream in addition to carrying large numbers of mites and lice as ectoparasites.

Melioidosis.—Naval Medical Research Unit No. 2 authenticated an outbreak of melioidosis on Guam during June-August, 1945. Some fatalities occurred. Rats were definitely tied in as a factor. An order was issued requiring special precautions to exclude rats from food stuffs and increased efforts to control all rodents on the island. This outbreak occurred following the return of troops from Okinawa. Suggestions were made that biological-warfare cultures of causative organisms may have been involved and introduced by Japanese amongst troops while they were on Okinawa.

Rat-bite fever; Weils disease, etc.—Reports were current that cases of rat-bite fever occurred in Philippine and South Pacific areas during military operations.

Some form of hepatitis was common in the Leyte Gulf-Samar area and Philippine Islands. Rats were suggested as a source of infections. Some of these cases had a history dating back to Guadalcanal, where infective foci were believed to exist.

Rodents were infested with ticks, fleas, and mites on the islands of Okinawa and vicinity. They could have been a factor in cases of hepatitis and related diseases reported from that area.

The surest and best way to prevent or control all rodent-borne diseases is to keep all rodent populations at the lowest possible levels. This was the aim and object of rodent-control work in the Pacific Ocean area.

RECOMMENDATIONS

A course of instruction in rodent-control field practices and techniques should be incorporated as a regular part of the curriculum for sanitation officers. This course of instruction could probably be set in at the University of California, Berkeley, Calif., where sanitation officers are being instructed.

Prebait and poisoned baits should be prepared and vacuum-packed in glass or tin at some central point in the continental United States. Feeder dishes and feeder-station covers together with complete instructions covering use of baits, should be packed with prebait and poisoned baits in convenient-sized units. These units of prepared baits and accessories would be placed on the classified list and supplied through naval supply depots to all naval activities. This procedure would assure standard-type baits for all activities and reduce hazards incurred by personnel in preparing baits in the field or aboard ship. Efforts should be continued to improve acceptability and effectiveness of baits and methods.

Trained rodent-control officers should be attached to principal naval commands as an integral part of medical office or epidemiology

units. These officers would maintain liaison with sanitation officers, pharmacist's mates, and other rated men actively engaged in rodent-control work at shore stations and aboard ships. A ship-fumigation unit should be attached to ComMarianas, Guam, to service all forward areas.

RODENT FEEDING EXPERIMENTS, BAIT, TRAILS, AND INTENSIVE CONTROL OPERATIONS, GUAM

RAT COLONY

A rat colony made up of live-caught wild rats was maintained at Island Command Rodent Control Unit. The wild rats were kept in cages for a 15-day period to accustom them to surroundings and feeding techniques before using them to check acceptance of prebaits and poisons. More than 200 rats were used over a period of 4 months. This work was supervised by Lt. (jg) Wilfred D. Crabb, H (S) U. S. N. R., assisted by Robert P. Loughrey, Ph. M. 2c, U. S. N. R.

Acceptability of baits and toxicity of poisons was checked and determined within reasonable limits and the findings applied to field practices.

FIELD BAIT TRIALS

A series of field bait trials was run on an extensive and intensive scale on representative type areas to check acceptance of bait materials, bait mixtures, methods of bait exposure, and weather factors.

Rolled oats as available for rations issue was found to be the most acceptable and durable bait material. Bread crumbs, corn meal, and prepared breakfast food were not as acceptable and did not have the keeping qualities of rolled oats.

Vegetable-oil baits of all available types, corn oil, cottonseed oil, and the mixtures and blends of salad oils, were used at the rate of 1 gallon of oil to each 100 pounds of bait materials.

Corn oil or Mazola was the best type vegetable oil. Acceptance of baits prepared with corn oil was slightly better than with other types of vegetable oils. There was less evidence of rancidity in corn-oil baits that were stored for any length of time.

Lard, bacon grease, and kitchen fats were tested for acceptance and keeping qualities in combination with bait materials. These fats and oils were definitely inferior in acceptance and keeping qualities in rodent baits.

Canned meats, fish, and meat products were combined with rolled oats and checked for keeping qualities and acceptance. It was determined that any type of meat baits would mold and become rancid in 24 hours. Acceptance of fresh mixed-meat baits was good where exposed in proximity to galleys, living quarters, and garbage dumps.



13. Typical "marginal" area adjacent to military camp. Such area furnished ideal natural habitat for rats.



14. Mountainous portion of island, showing typical grasslands, with small patches of brush and trees. Both species of rats are common in this type habitat.

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15. Typical grass-type area adjacent to military camp. Rats are not too numerous in this type of cover and control is not difficult.

Cocoanut baits (dried cocoanut (copra)), were cut in $\frac{1}{4}$ -inch cubes and soaked in a water solution containing "1080." These cubes were dried on a screen and stored for future use. This type of bait was used in native cover and broadcast at the rate of 1 to 2 pounds per acre. Bait pieces would deteriorate in 2 to 3 days to the point where they were unacceptable by rodents. This was the only suitable type of bait that could be used on a "broadcast" basis in native cover.

Dried cocoanut (copra) was ground in a food grinder or put through a "hammer mill" to expel a part of the oil and reduce the copra to small pieces or a fine meal. This ground copra was mixed at the rate of 1 pound to 4 pounds of oatmeal. This cocoanut-rolled oats bait was found to be acceptable when freshly mixed. If the bait was retained in storage for more than 10 days, it developed a typical cocoanut or soapy odor. Apparently the free acid in the cocoanut had accelerated oxidation and produced objectionable rancidity in the baits. It was observed that the rats would eat the oatmeal and leave the cocoanut meal. This was also observed where fresh cocoanut was ground and mixed with oatmeal and held in storage for any length of time. No attempt was made to use a preservative or anti-oxidant.

Cocoanut-oil was used in lieu of other vegetable oils, and found to be the most acceptable type of oil for use with oatmeal. There was no evidence of any appreciable rancidity in cocoanut oil-oatmeal baits where the oil was obtained from good grade copra and the bait was not kept in storage longer than 10 to 20 days.

The taste or odor factors present in oils and greases and responsible for attracting rodents could not be determined. It was demonstrated that an oil or grease to be acceptable had to possess a high degree of anti-oxidation or lack of rancidity. This type of oil generally possessed a body and consistency that would carry poisons and also coat the bait material and make it generally moisture proof.

WEATHER

Weather was found to be very much of a deciding factor in rodent control operations. If it was rainy, windy, or blustery, the rodents (particularly rats) were variable in their eating habits. Clear, calm weather was conducive to a good "take" of prebait and poison. This was noted in connection with any type of field checks or feeding experiments.



16. Typical camp margin, showing good rat harborage in native cover. Island Command area, Guam.

BLANKET OR COMPLETE COVERAGE

Blanket or complete coverage of any given area was found to be a necessity in any type of rodent-control operations. The system as worked out on Guam indicated that feeder stations should be placed at 100-foot intervals in checkerboard fashion throughout any given military area and the marginal areas for a depth of 300 feet. This system of baiting assured that every rodent in the treated area would come in contact with prebait and poison bait. This system was adopted as standard practice in most of the forward areas.

BANDING

Banding trees with tin strips that would completely girdle the tree and be not less than 8 inches in width was found to be very much of a help in reducing the rat food and cover in any military camp area. These tin strips were made out of large-sized tin containers or scrap metal, and nailed securely to the trunk of the tree at least 5 feet above ground level. Rats could not climb the trees to find food and shelter.

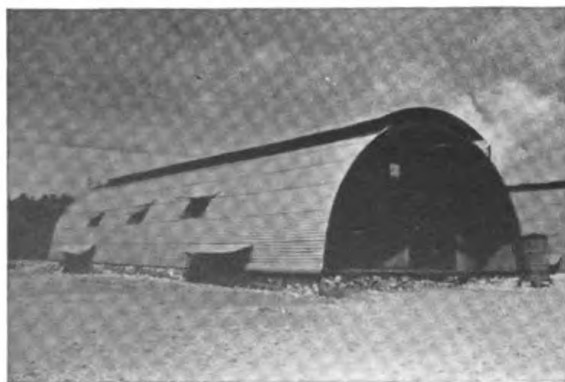
NATIVE COVER

Native cover, consisting of shrubs, grass, small trees, and vines supplied good rodent harborage and considerable food for rodents. Removal of this type of native cover from military areas greatly simplified control operations.

GENERAL CLEAN-UP

General clean-up and sanitation was stressed as an aid to rat control. Removal of trash piles, trees, and rubbish left in the wake of the construction program was a problem in all military areas. Disposal of camp refuse and garbage by burning, burying, and dumping at sea was worked out on a fairly satisfactory basis following establishment of permanent camp sites. In the early days of occupation,

temporary trash dumps were not well located or properly supervised and were a menace to good sanitation.



17. Quonset huts placed too close to ground and then banked up with rocks creates an ideal rat harbor. Island Command area, Guam.

RAT-PROOFING AND PERMANENT CONTROL

Rat-proofing and permanent control was stressed as a part of building and improvement programs. Emphasis was placed on the use of concrete decks in

warehouse and storage areas. Elevation of wooden decks in living quarters by setting floor supports on 18-inch high concrete blocks was suggested as a standard practice but this suggestion was considered to be in variance with typhoon-proof construction and ruled out. In many camp areas, the Quonset huts and other buildings have been set flush with the ground or just slightly elevated. This has created good haborage and a constant source of trouble in controlling rodents.



18. Quonset storage warehouse set on concrete foundation. A good type of ratproof construction. Fifth Field Depot, Guam.

RODENT CONTROL IN NATIVE VILLAGES

Rodent control in native villages was initiated as a military government activity with the twofold purpose of teaching natives how to control rodents and to reduce health hazards. It was deemed expedient to use red squill and antu as rodenticides in native villages to eliminate the possibility of accidental poisoning of humans. Natives responded to instruction, eliminated much of the food and cover, and used prebait and poison baits as well at 60- to 90-day intervals. Native villages are so situated that rodents are constantly migrating from marginal lands into houses and buildings, necessitating periodic retreatment with prebait and poison baits. Red squill and antu are not good rodenticides for use on Pacific rats and results in native villages were variable, but not up to standard.

POISONS AND THEIR EFFECTIVENESS

Red squill and *antu* were used in concentrations of 1 pound to 10 pounds of bait materials. It was necessary to double the usual amount of oil to get good adherence of poisons to the rolled oats. It was observed that results from use of these poisons was variable and generally unsatisfactory.

Zinc phosphide powder in a 2 percent mixture in oil-rolled oats bait was found to be generally satisfactory in dry weather. The baits showed a tendency to "break" in damp, wet weather and become soggy and unacceptable. There was evidence of lessened toxicity and generally unsatisfactory results. No effort was made to find a stabilizing agent. Use of this poison was restricted to periods of low humidity and rainfall and generally high temperatures. If a good stabilizer and a heavy-bodied spreader could be used in preparation of zinc-



19. Typical type native habitat. Ideal situation for rats. Price School area, Guam.

phosphide baits, this rodenticide should be satisfactory for general use in Pacific Ocean areas.

Thallium-sulfate powder in a 1.5 percent to 2 percent mixture in oil-rolled oats bait was found to be very satisfactory for use on military areas. The percentage of thallium sulfate was varied slightly to compensate for differences in volume and texture of bait materials. There was no evidence of detection of taste or odor by rodents. Secondary poisoning was not a factor to be considered. Very few dead rodents were found in open areas and domestic animals did not eat the carcasses to any extent.

Sodium fluoroacetate ("1080") powder in a concentration of 1:256 and used in various types of baits on an experimental basis showed good acceptance and a relatively high percentage of control. There was evidence of an objectionable taste factor in some types of baits. The hygroscopic nature of this material requires special handling and baits showed a tendency to leach out very readily. Coconut baits were easily prepared with "1080" dissolved in water. The dried coconut pieces were soaked in "1080" solution and the excess moisture allowed to evaporate from coconut. This type of coconut bait was used in treating marginal lands to reduce rodent populations and delay reinfestation of military camp areas. "Ten eighty" is very specu-

lar in that it knocked the rodents down almost immediately and many of them died close to the bait spots or feeder stations. Secondary poisoning of cats and dogs was not reported. There was no evidence of birds being killed with "1080" baits.

Barium carbonate and arsenicals were not used or checked. Previous checkup and experimentation had demonstrated that these materials were not good rodenticides.

TRAINING SCHOOLS AND INSTRUCTIONS IN CONTROL OPERATIONS

The Island Commander issued a directive for all sanitation officers to attend a rodent-control training school held at Island Command Headquarters, 5 January 1945. This school was the first step in the initiation of an island-wide rodent-control program. The basic requirements of a good control program were set up at this school and all subordinate military commands agreed to supply the necessary men, materials, and equipment to do the control job in their respective areas.

The Army Garrison Forces scheduled a 2-day training school at 90-day intervals for sanitation officers and enlisted men assigned to do rodent-control work in Army camps.

Marine divisions held rodent-control training-school sessions for units coming to and leaving the island.



20. Modern type house. Some rat harborage under house and marginal area. Barrigada village, Guam.

Naval units doing rodent-control work were assembled at convenient points and times throughout the island and indoctrinated in the techniques of controlling rodents. The island rodent-control unit sponsored this training program and used it as a means of keeping new crews up to date on control problems and procedures. Sanitation officers were contacted frequently to make sure that control operations did not lag.

RODENT-CONTROL PICTURES—GUAM

The pictures accompanying this report were taken on Guam to show typical situations having a bearing on rodent-control operations. These same conditions are generally found throughout the South and West Pacific Ocean areas.

APPENDIX

HISTORY, RODENT CONTROL OPERATIONS, PACIFIC OCEAN AREA

Rodent-control operations on naval shore bases, adjacent military and civilian areas, was initiated in the South Pacific in 1943.

NEW CALEDONIA AND NEARBY ISLANDS

Lt. (jg) Wilbert D. Crabb, H (S) U. S. N. R., arrived at Noumea, New Caledonia, in November 1943. He was assigned to the naval command and given the duty of organizing and supervising rodent-control work on the entire island. Operations were extended to include all military installations and nearby towns.

Supplies and poisons were scarce during early stages. Barium carbonate, antu, and red squill were the poisons generally used. Zinc phosphide and thallium sulfate were received at the close of 1944. Cereals and meats were used to prepare various types of baits.

Norway-, Alexandrine-, and exulans-type rats were prevalent in this area. Norway rats were generally confined to towns and villages.

Control work was initiated on island groups north and northwest of New Caledonia by Lt. (jg) Crabb during the last half of 1944. He was transferred to Island Command, Guam, January 1945 and assisted with rodent operations at that point until August 1945 when he departed for the United States mainland. He supervised the collection and preparation of a series of rodent specimens at New Caledonia and Guam; also supervised cage and field tests on acceptance of baits and poisons by rodents on Guam.

SOUTH PACIFIC: ESPIRITO SANTOS-EFATE ISLANDS AREA

Lt. (jg) Arthur K. Crews, H(S) U. S. N. R., arrived in the South Pacific in April 1944 and was assigned to the naval command to supervise rodent-control work in the Espirito Santos-Efate area. He was handicapped by a shortage of bait materials, poisons, and traps. Late

in 1944 the supply situation was eased with the arrival of zinc phosphide and thallium sulfate poisons.

Following the transfer of Lt. (jg) Crabb to Guam, Lt. (jg) Crews took over the supervision of control work in New Caledonia. Military activities were gradually liquidated in the South Pacific area and he departed for the West coast, United States, October 1945. His departure marked the close of organized rodent-control work in the South Pacific.

SOUTH PACIFIC: RUSSELL ISLANDS, GUADALCANAL AREA

Ensign Charles E. Scull, H(S) U. S. N. R., departed from the United States 7 April 1944 for the United States Naval Base, Russell Islands, and upon arrival he was assigned to the naval command and detailed to organize rodent-control operations in the Russell Islands, Guadalcanal area. Lack of supplies hindered the work program until the last months of 1944. Military operations were curtailed in this area and organized rodent-control operations were discontinued upon the departure of Ensign Scull for the continental United States in July 1945.

SOUTHWESTERN PACIFIC, 7TH FLEET AREA

A group of rodent-control officers was assigned to the Seventh Fleet Medical Officer for duty at various shore stations in the area covered by that fleet. Bait materials and suitable poisons were not available in quantity during early phases of work in the Philippines and the Seventh Fleet area. Control of scrub typhus was handicapped due to lack of supplies to control rodents. Red squill and barium carbonate were used at the outset of work and replaced by zinc phosphide, thallium sulfate, and "1080."

Lt. Milton H. Webster, H(S) U. S. N. R., departed from the United States in August 1944 and arrived at Milne Bay in September. His first duty station was on Leyte during the early stages of the invasion of that island. He initiated rodent-control work at naval installations in the vicinity of Manila, Zamboango, and Guiuan, P. I. While at Guiuan, Samar, P. I., large-scale control operations were initiated to reduce rodent populations on endemic scrub typhus areas. Airplane distribution of baits was used as a phase of this operation.

Supervision and instruction was given in treatment of PT boats and other small craft with Cyanogas to control rodents and insects. This work was done as a phase of decommissioning and lay-up program for small craft. The results of this work were reported as being very satisfactory.

Lt. Webster arrived at Guam in November 1945 and was assigned to temporary duty on Iwo Jima where an island-wide rodent-control

program was initiated. He returned to the United States in January 1946.

Lt. Jesse E. Barker, H(S) U. S. N. R., departed from the United States in August 1944 and arrived at Milne Bay in September. His first duty station was at the United States Naval Station, Manus Island. From this station he went to naval stations on Leyte, Samar, and Luzon in the Philippine Islands where he initiated and assisted with rodent-control work. His main duty station was at Subic Bay, Luzon, P. I. At this point he initiated and supervised rodent-control operations on all naval installations. He arrived at Guam November 1945 and was given temporary duty on Truk Atoll where a control program was initiated. He returned to the United States in January 1946.

Lt. Willard W. Lahnum, H(S) U. S. N. R., departed from the United States for duty with the Seventh Fleet in June 1945. He was assigned to work with rodent-control units at Manila and Guiuan. At Guiuan, Samar, Lt. Lahnum cooperated with Epidemiology Unit No. 61 in making a survey of ectoparasites and scrub-typhus virus in local rodents.

Lt. (jg) Lloyd E. Ulbrich, H(S) U. S. N. R. departed from the United States in November 1944 for duty with the Seventh Fleet. His first station was at Milne Bay, followed by duty at Tacloban and Tolosa, Leyte, P. I. While at Tacloban he assisted Naval Medical Research Unit No. 2 in making a survey of rodent populations in relation to schistosomiasis, and infected rodents as indicators of schistosomiasis infestations. He was assigned to the Eighty-third Naval Construction Battalion for duty in the vicinity of Tientsin or Tsingtao, China, and was in that area at the end of January 1946.

Lt. (jg) George N. Alpaugh H(S) U. S. N. R. departed from the United States for duty with the Seventh Fleet in November 1944. His main duty station was Manila, the surrounding area including Cavite, Corregidor, and the adjacent Army camps. On request of coordinated military commands in the Manila area a comprehensive rodent-control program was prepared and submitted by Lt. (jg) Alpaugh. This program was not activated due to the inability of commands to agree on supervisory personnel and the basis of furnishing supplies. Naval installations in the Manila Bay region were supplied with baits and treated under Lt. (jg) Alpaugh's direction. Army, Red Cross, and municipal areas were treated for controlling rodents, baits and supervision being supplied by the naval rodent-control unit. The heaviest rodent population in the Seventh Fleet area was centered in Manila. Lt. (jg) Alpaugh was at the Manila naval base at the end of January 1946.

Lt. (jg) Lloyd A. Morley, H(S) U. S. N. R. was assigned to rodent-control duty with the Seventh Fleet in June 1945. His previous training and experience had been in public health and epidemiology. He was assigned to make a plague survey in the Manila Bay region during the summer of 1945. In October he was assigned to the Ninety-sixth Naval Construction Battalion for duty in the China area. At the end of January 1946 he was reported in the vicinity of the Shantung peninsula, China mainland.

WESTERN PACIFIC: OKINAWA AREA.

The Commanding General, Tenth Army, requested assignment of naval rodent-control officers to make a survey and inaugurate a rodent-control program in the Okinawa area. This survey and control program was initiated in May 1945 by Lt. Comdr. Thomas B. Murray, H(S) U. S. N. R., assisted by Lt. (jg) William J. Bricker, H(S), U. S. N. R., and Ensign Maynard W. Cummings, H(S) U. S. N. R., Lt. Clyde R. Madsen, H(S) U. S. N. R., arrived in the area in July 1945. An Army malaria-control team was assigned to the area rodent unit for training and duty in rodent-control field work.

The area rodent-control unit was attached to the Island Command Medical Office and assigned the duties of preparing and distributing prebait and poisoned baits, together with supervision of all control operations on military and civilian areas. This unit was fully activated during the period from May to December 1945.

Bait and poison supplies were not available in ample quantities during May and June, but in July a plentiful supply of all materials was available. Prebait and poisoned bait was prepared with salad oil and distributed in feeder stations. Zinc phosphide, thallium sulfate and "1080" were used as poisons on military areas. Red squill was used in civilian camps and villages. Control operations were area-wide and adequate control was maintained on principal military installations. A total of 21,749 pounds of prebait and poisoned bait was supplied to military and civilian units during period from 10 May to 31 December 1945.

Lt. (jg) Bricker was assigned to rodent control for duty in Okinawa 16 May 1945. He arrived at Okinawa the latter part of May and assisted with the organization and supervision of control operations on Okinawa and nearby islands. On the departure of Lt. Comdr. Murray, the latter part of July, Lt. (jg) Bricker took over the supervision of the rodent-control unit. He left Okinawa in November 1945.

Lt. Madsen was assigned to rodent control in April 1945 for duty at Okinawa. After arriving there, 5 July 1945 he was assigned to the island rodent-control unit. On departure of Lt. (jg) Bricker for

the United States, Lt. Madsen took over the supervision of the control unit. He was assigned to rodent-control duties with the Second Marine Division on the Japanese mainland in December 1945.

Ensign Cummings was assigned to the rodent-control unit at Okinawa in April 1945. He arrived at Okinawa in May and continued with the island rodent-control unit through December 1945 when he received orders to report to the First Marine Division, China, for duty as rodent-control officer.

HAWAIIAN ISLANDS AREA

The territorial government and the U. S. Public Health Service have maintained organizations for controlling rodents incident to plague suppression throughout the territory. The Hawaiian Sugar Planters Association, through its experiment station staff, has done some excellent research work on rodent-control field practices. The association pioneered the use of the feeder-station technique in controlling field rodents, principally rats.

Lt. Comdr. Maynard S. Johnson, H(S) U. S. N. R., was assigned to rodent-control duties in the Fourteenth Naval District, Pearl Harbor, in July 1944. His points of duty were on Oahu, Midway, and Maui Islands. While on Midway he ran a series of bait-acceptance trials on local rat populations, results of which were reported in the Naval Medical Bulletin, August 1945. He was attached as rodent-control officer to Epidemiology Unit No. 106, Fourteenth Naval District Command, Pearl Harbor, in November 1945. Lt. Comdr. Johnson used every means at his disposal to maintain adequate ship-shore rat-control measures at points in the Hawaiian Islands.

WESTERN PACIFIC: MARIANAS-CAROLINE ISLANDS

Large areas in these island groups were utilized for basing personnel and storing matériel. Extensive and intensive rodent-control operations were initiated on the main islands within the groups.

Initial control operations were set up on Guam. Much experimental work was done to determine the most acceptable type of baits and bait placements. A rat colony was maintained to check against field trials and determine toxicity of poisons. This work formed the basis for recommendations and operations on Western Pacific islands.

Supplies of critical poisons, zinc phosphide, thallium sulfate and "1080" were assembled at Guam and shipped to points in the Pacific as needed. A plentiful supply of poisons and bait materials was on hand in all forward areas when hostilities ceased. Prepared baits were made up at Guam and shipped to naval activities in the Caroline, Admiralty, Okinawa, Bonin, and Philippine islands. Baits and poisons were supplied to the Navy, Army, and Marine Corps units in China and Japan. A mechanical bait-mixing machine was made by

the Twenty-third Naval Construction Battalion for use in preparing prebait and poisoned baits at Guam.

Lt. Comdr. T. B. Murray H(S) U. S. N. R., was assigned to rodent-control duties and arrived at Guam in December 1944. He was attached to the Island Command Medical Office. Temporary additional duty orders were given at Cinpac to initiate, organize, and check rodent-control work at Rota, Tinian, Saipan, Marianas Islands; Ulithi, Peleliu, Anguar, Truk and adjacent islands; Caroline Islands Group; Okinawa and nearby islands, Admiralty islands; Manus, Los Negros, etc.; and Leyte, Samar, Luzon and adjacent islands in the Philippines. The methods of control were standardized, supplies of critical poisons and materials were assembled at central points, and redistributed to all adjacent areas as needed.

Ensign George C. Moore, H (S) U. S. N. R., was assigned to rodent-control duties and arrived at Guam in August 1945 as relief for Lt. (jg) Crabb. He assumed duty as the island rodent-control officer, Guam, when Lt. Comdr. Murray was absent from the island and finally detached, 2 January 1946. Ensign Moore was in charge of rodent-control operations on Guam at the end of January 1946.

An effort was made by Lt. Comdr. Murray to induce rodent-control officers and all units doing rodent-control work to collect specimens of rodents and their parasites and forward them to the National Naval Medical Center, Bethesda, Md., for inclusion in the National Museum collection. A representative collection of rodents and their ectoparasites was secured from all of the principal islands where control work was done. From this collection the range and distribution of species and subspecies can be worked out.

Personnel attached to all rodent-control units in the Pacific Ocean area were given special training in control techniques and preparation of specimens. Results accomplished can be largely attributed to the good work of enlisted men.



NOTES ON NAVAL RESERVE CONTRIBUTORS

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- Engelfried, John J.**, Commander H(S) USNR (*A Suggested Modification of the Bogen Procedure for Determination of Alcohol in Body Fluids*, p. 1222). B. S., M. S. P. H., D. P. H., University of Michigan. Instructor, Clinical Chemistry and Bacteriology, Department of Pediatrics and Infectious Diseases, University of Michigan Medical School, 1934-41. Member American Association for the Advancement of Science, American Public Health Association, Michigan Academy of Science, Arts and Letters.
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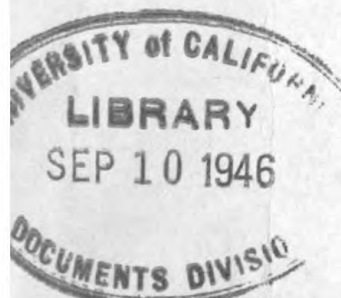
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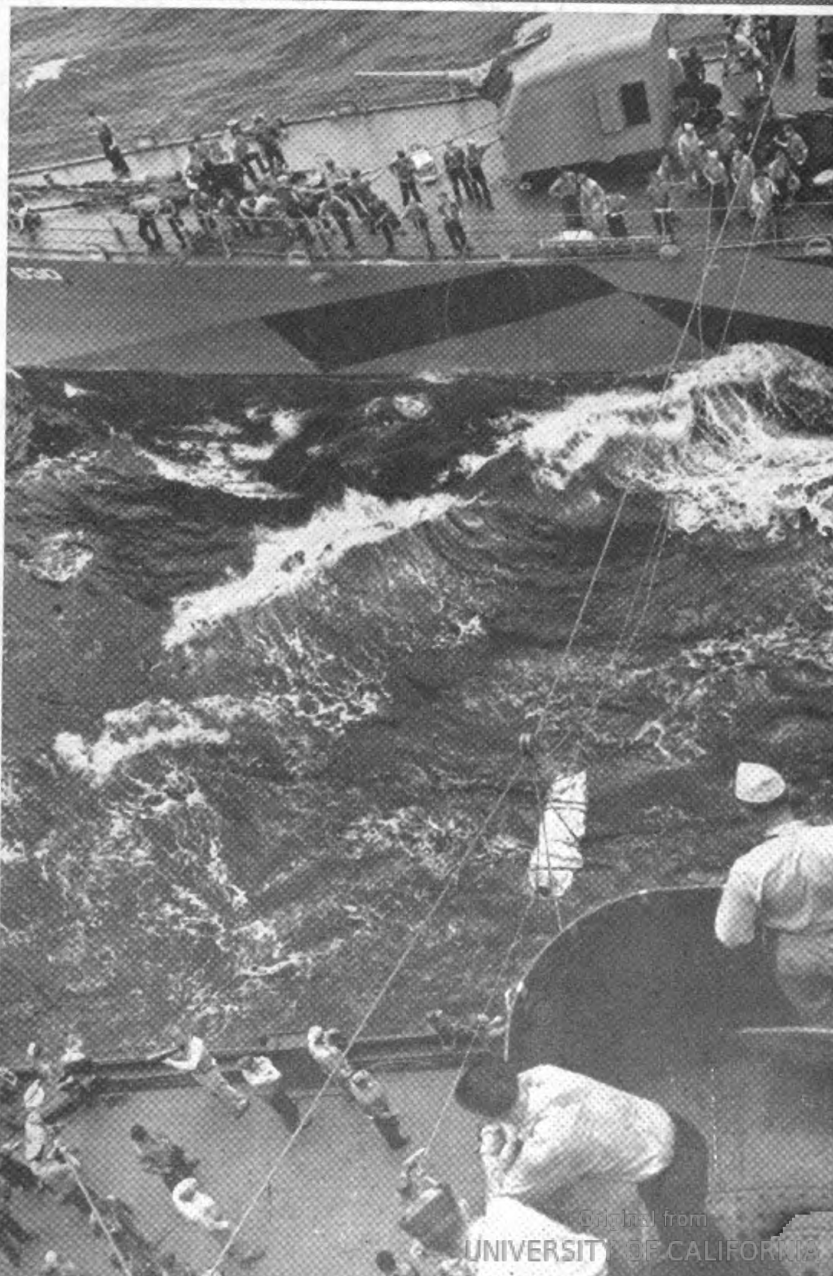
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COVER PHOTOGRAPH

Naval medicine in a dramatic moment. A wounded man being transferred at sea for treatment. This incident occurred off Saipan during the capture of that island in the summer of 1944.

—Official U. S. Navy photo.

VOL. 46

SEPTEMBER 1946

NO. 9

UNITED STATES NAVAL MEDICAL BULLETIN

THE MISSION OF THE MEDICAL CORPS OF THE NAVY
TO KEEP AS MANY MEN AT AS MANY GUNS
AS MANY DAYS AS POSSIBLE



MONTHLY

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NAVY DEPARTMENT,
Washington, March 20, 1907.

THIS UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of that Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T McINTIRE,
Surgeon General, United States Navy.

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Contributions to the BULLETIN should be typewritten, double-spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The BULLETIN endeavors to follow a uniform style in headings and captions.

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The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to the Bureau of Medicine and Surgery in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

LOUIS H. ROBBIS, *Editor,*
Captain, Medical Corps,
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U. S. NAVAL MEDICAL BULLETIN

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SPECIAL ARTICLES

THE PATTERN OF INJURIES PRODUCED BY THE ATOMIC BOMBS AT HIROSHIMA AND NAGASAKI

SHIELDS WARREN
Captain (MC) U. S. N. R.

and

RUPERT H. DRAEGER
Captain (MC) U. S. N.

The pattern of injuries which occurred as a result of the atomic-bomb explosions at Hiroshima and Nagasaki at first appears diverse and confusing. These injuries ranged from instant death by crushing or fire to delayed radiation sickness evidenced by weakness and lassitude appearing weeks after the explosion. A wide variety of terms has come into use to describe the clinical entities encountered, and the problem of working out a satisfactory classification on an etiological basis is difficult because of this great diversity. Often, too, several types of injury may be present in a single person. Yet classification is essential if we are to understand the problems involved and so to diagnose the cases that their relative importance may be realized and that they may be available for study in the future. Fortunately, analysis of the injuries suffered by the atomic-bomb victims does reveal a clear pattern and enables us to present a classification that we believe will be useful.

The explosion of an atomic bomb releases energy which is dissipated in several ways, some of which are similar to those of a high-explosive bomb and some of which are entirely new in the use of destructive implements. This classification of the types of injury due to the explosion of the atomic bomb is based on that acceptable for injuries produced by the detonation of ordinary high explosives in

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the vicinity of man and extended to include the radiation effects of this weapon on the human body.

The etiologic subdivision of types of blast injury into those due to air blast, water blast, and solid blast has been presented by Draeger and his associates (1). To this classification we propose adding the term radiation-blast injury to include the additional types of injury, previously unknown as the result of an explosion, but characteristic of the explosion of the atomic bomb. This classification will be presented in detail in a forthcoming article (2).

The scale of casualty production by an atomic-bomb explosion is appalling; at Nagasaki, 40,000 killed and 45,000 seriously injured, at Hiroshima, 80,000 killed and 80,000 seriously wounded. A greater number of injuries was probably caused by ionizing radiation-blast effects, gamma rays, and neutrons than by any other type of injury resulting from the explosion of the bombs. However, since the effects of this ionizing radiation take hours, days, or even weeks to appear, their importance was largely masked by the great numbers killed by flash burn, fire, or wreckage of buildings well before the time that symptoms due to irradiation could develop.

At Hiroshima and Nagasaki we did not encounter evidence of injury due to water blast¹ or solid blast. Therefore we shall restrict our discussion to the injuries produced by air blast and by the thermal and ionizing effects of radiation blast from the atomic-bomb explosion. Air blast can produce injuries in several ways, depending upon the material medium which transmits the energy of the explosion to the human body.

As in the typical high-explosive bomb detonation, there was an outrush of superheated air and gases capable of producing injuries of the flash-burn type or of setting secondary fires which can cause flame-burn injury. Flash burns produced in this way involve all exposed surfaces as the hot air envelops the victim. If the temperature is sufficiently high actual charring will occur, even of clothed surfaces.

The third phase of air blast is the air-pressure wave which travels outward from the focus of detonation. This form of air blast accounts for the majority of injuries in explosions of large charges. The advancing compression wave in air will at times produce injury in those individuals subjected to its impact (first thrust, then compression as envelopment by the wave occurs) by tissue disruption at tissue-gas interfaces, such as the lung, air- or gas-filled portions of the intestine or stomach, or the ear drum. This type of injury is relatively

¹ Some survivors among children were swimming at the time of the bomb burst, but not sufficient energy was transmitted to the water to produce water-blast injuries.

rare, since the critical pressure for personal injury is reached in an area small by comparison with that in which buildings are wrecked.

By far the greatest source of air-blast injury is displacement as the pressure wave moves outward, either of the victim himself (flung against the ground or a building or the wreckage hurled against him) or displacement of debris due to structural collapse. The wreckage of structures by the pressure wave may at times produce secondary fires through the ignition of debris by household fires or electric short-circuits. Both at Hiroshima and Nagasaki the area of pressure-wave destruction exceeded that of destruction by fire. Many were killed by flying debris, crushed beneath collapsed houses, or pinned in the wreckage to await death by fire.

The unique feature of an atomic-bomb explosion is the liberation as electromagnetic radiation and neutrons of a great portion of the energy produced by fission.

This radiation is thermal in part, and in part ionizing. The infra-red rays caused flash burns. Owing to the intensity and the very brief period of emission of the rays, sharply demarcated burns ranging from erythema and slight blistering to extensive third-degree burns occurred. These flash burns occurred on exposed surfaces and were readily distinguished from the flash burns produced by envelopment in hot gases, since the skin in the shadow of a nose, an ear, or an upraised arm was protected.

Not only did the radiant heat liberated by the detonation cause primary flash burns, but some fires sprang up in the areas wrecked by the air blast of the bomb. Whether these fires were due to radiant heat or hot gases from the bomb could not be determined. They, as well as those caused by overturned cooking fires and by electric short-circuits, produced a number of flame burns.

The visible components of the thermal radiation apparently did little or no harm even to the eyes, probably due to the very short period of their emission. Whatever effect the ultraviolet rays might have had was masked by the damage done by the more deeply penetrating infra-red rays.

Peculiar to the atomic-bomb blast is its ionizing component, delivered in terrific intensity, to which we have given the name "radiation blast, ionizing." Those affected by it showed the same general sequence of pathological changes that follow exposure to a heavy dose of roentgen rays.

The effect of both gamma rays and neutrons on tissue is to cause ionization, and thus the pathologic changes produced are qualitatively identical, and cannot be differentiated.

Primary ionizing-radiation blast produces effects comparable to those well known from studies of high voltage x-ray or radium radi-

ation. Patients from Hiroshima and Nagasaki presented essentially the same clinical course and anatomic changes. The time of appearance of symptoms, and indeed the clinical course following exposure to ionizing-radiation blast, depended on the amount of radiation absorbed. Some of the more important pathologic findings have been presented by one of us.

At first no change was noted objectively. Subjectively, however, nausea or malaise (radiation sickness) appeared early. Within a few hours lymphocytopenia appeared in those more heavily exposed. The most heavily radiated cases died in a few days, probably as a result of toxic autolysis of tissue. Those who lived longer showed selective injury, usually to bone marrow or gonads. The clinical course of those showing selective bone-marrow injury could be divided into several groups according to the predominant feature, leukopenic, hemorrhagic, anemic.

After several days, or even up to 3 to 4 weeks, leukopenia was so severe in some as to permit the development of Ludwig's angina, ulcerative entero-colitis, furunculosis, or other infectious lesions. If recovery occurred, hyperplasia of hematopoietic tissue developed; this was not always signalled by leukocytosis.

More or less paralleling the leukopenia, but lasting longer, hemorrhagic manifestations became clinically obvious, and were accompanied by thrombocytopenia. The peak of hemorrhagic deaths was in early and mid-September, 3 to 6 weeks after the exposure. Most of the optic injuries that we encountered in Nagasaki survivors occurred as a result of retinal hemorrhages during this period.

The slowest hematologic change to develop was anemia, at first mild, then more severe. Recovery to a greater or lesser degree occurred in some. Others died with red blood cell count of 1,000,000 or below.

Along with the hematologic changes atrophy of lymphoid tissue occurred, followed by slow regeneration.

Epilation was quite frequent, and histologic examination showed not only damage to follicles, but damage to sebaceous and sweat glands as well.

Since gonadal tissue is highly radiosensitive, it was not surprising to find cessation or impairment of spermatogenesis.

Injury to the ovaries was less frequent, as the body usually protected them partially from the radiant energy.

In no one did we find evidence of injury due to induced radioactivity. However, with more powerful bombs this is possible, as phosphorus and other elements in the body might be activated to a dangerous degree by the neutrons emitted by the explosion.

Residual radioactivity due to contamination of the area by fission

products of the bomb is a conceivable happening. We were able to locate a few persons who had come into the area shortly after the explosion at Nagasaki and had remained there for some weeks. None showed evidence of injury.

As a summary of the actual and potential causes and forms of radiation blast injury we present in table 1 a suggested classification.

TABLE 1.—*Radiation-blast injury*

Cause	Resultant
1. Thermal (electromagnetic radiation).	1. Burns. (a) Flash, due to infra-red and ultra-violet rays. (b) Flame, due to induced fire.
2. Ionizing radiation: (a) Gamma rays and neutrons.	2. Radiation effects: (a). Radiation sickness, blood and lymphoid dyscrasias, skin damage, gonadal damage, induced tumors. (b). Blood dyscrasias.
(b) Induced radioactivity in individual and environment.	(c). Blood dyscrasias, induced tumor.
(c) Residual radioactivity from fission products.	

REFERENCES

1. DRAEGER, R. H., BARR, J. S., and SAGER, W. W.: Blast injury. J. A. M. A. In press.
2. WARREN, S: Effects of instantaneous dose of radiation. Cancer Research. In press.



THE INACTIVATION OF PITOCIN AND PITRESSIN BY HUMAN PREGNANCY BLOOD

Authors' summary and conclusions.—1. Blood from humans from about the fifth month of pregnancy to at least seven days post partum can rapidly inactivate Pitocin and Pitressin as tested by their oxytocic action on the pregnant human uterus. These observations serve as additional data that the posterior pituitary is not the causative agent of parturition in humans.

2. Blood from males, non-pregnant females, and early pregnancy cannot inactivate these substances as rapidly.

3. Toxemic patients appear to be more sensitive to the oxytocic action of Pitocin.

4. Toxemic patients can inactivate pitocin and pitressin as rapidly as normal patients. The hypersensitivity of pre-eclampsics and eclampsics to vaso-pressin and oxytocin is not associated with a diminished ability of the blood to inactivate these substances.—WOODBURY, R. A., AHLQUIST, R. P., ABREU, B., TORPIN, R., and WATSON, W. G.: The inactivation of pitocin and pitressin by human pregnancy blood. J. Pharmacol. & Exper. Therap. 86: 359-365, April 1946.

DIAGNOSIS AND TREATMENT OF LOCALIZED INFECTIONS IN THE HAND

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Few problems can tax surgical judgment more than those dealing with the recognition and proper drainage of infections in the hand. This field was clarified long ago by Kanavel and in recent years has been kept before the profession in the writings of Koch, Mason, Bunnell, Auchincloss and others. It is generally recognized that an infected hand is a serious condition whose skillful management requires an intimate knowledge of the fascial planes and spaces in order to foretell the route of spread of the infection and to provide adequate drainage. These infections require immediate treatment and the surgeon who has the opportunity for early incision has also the opportunity to aid the patient or to do serious harm. Medical officers at sea and at isolated shore stations have little opportunity for consultation and must do the best with what they have on hand. It is the purpose of the writer to reiterate the principles of treatment and to emphasize general details common to all cases, points in diagnosis and treatment of specific types, and some details in the aftercare that help to prevent deformities and preserve function.

GENERAL CONSIDERATIONS

As elsewhere in the body, infections of the hand begin as acute spreading inflammations which sooner or later, depending on the resistance of the patient, virulence of the organism, and the medical care, become localized collections of pus which must be evacuated. It is important, however, that one be certain the infection is localized before the hand is incised. In the hand, fluctuation is not a criterion of localization since the firm fascial partitions hold the pus under pressure and by the time this sign can be elicited, much damage has been done. A firm, exquisitely tender swelling limited to a definite area and surrounded by an erythema which has changed from fiery red to a deeper violet color usually indicates an abscess which needs drainage. If there is some question, it is often best to continue the warm wet dressings another 24 hours rather than to risk incising an area of acute cellulitis. Inasmuch as infections of the anterior closed space of the distal phalanx and the tendon sheaths require very early drainage for good results, a fine degree of judgment must be exercised.

The hand is best prepared for operation by gently washing with soft cotton, soap, and sterile water. All crusts and epithelial debris are removed, the nails cleaned, and the hair shaved before the patient is brought to surgery. Iodine and similar antiseptics have no place in the preliminary cleansing.

General anesthesia is preferable to local anesthesia because it eliminates the possibility of damage to the tissues or further spread of the infection through infiltration of novocaine. Sodium pentothal, nitrous oxide, or a combination of these two agents is satisfactory for short procedures. However, in the naval service general anesthesia is not always available. Nerve block at the wrist or at the base of a digit can be used, although the point of a hypodermic needle passing through lymphatic channels in a finger has been known to cause an infection at this site more serious than the initial abscess.

A bloodless field is necessary if the small structures are to be identified and can be obtained by wrapping a blood-pressure cuff around the upper arm, elevating the extremity for about 45 seconds to allow venous blood to drain out, and then inflating the cuff to 250 mm. pressure of mercury.

The incision, besides making available the shortest avenue to the abscess cavity, should also be placed so that it is parallel or directly over the flexion creases, never at right angles to them and never down the midline of the fingers. Midline incisions allow tendons to herniate forward and healing occurs with the formation of a deforming contracture.

The dissection is carried out with the same care, gentle handling of tissues, and accurate hemostasis that characterizes the approach to a freshly divided nerve or tendon. Vital structures must be clearly visualized, identified, and retracted to safety. Necrotic tendon, bone sequestra, and other dead tissues are carefully cut away. Careful atraumatic technique will result in wounds which heal with a minimum of scar, maximum return of function, and yet provide adequate drainage without damage to surrounding tissues. The act of boldly plunging a knife into a bloody field, with total disregard for adjacent structures, is the mark of a thoughtless surgeon.

The ability to visualize spaces of the hand, to know the adjacent structures and the possible routes of spread of the infection is a necessary counterpart to accurate diagnosis and treatment. In the paragraphs that follow, each type will be discussed separately and the spatial boundaries and relationships involved will be described.

FELON

The insertion of the flexor digitorum profundus is at the base of the distal phalanx and distal to this the skin is fastened to the periosteum

by tough fibrous bands interspersed between the subcutaneous fat and the blood vessels which supply the shaft of the bone. This is commonly called the anterior closed space (2). It may be infected by puncture wounds or by some minor unnoticed injury. Since the structure of the space does not allow for expansion, severe throbbing pain is an early diagnostic feature of a felon. If the pus is not evacuated, necrosis, rupture to the outside, and early osteomyelitis occur.

The pain often keeps the patient awake at night. The most characteristic feature, however, is the firm swelling limited exactly to the distal phalanx.

Occasionally, in early stages when there is no induration, warm wet dressings and immobilization may abort the infection. This is not probable, however, and if the phalanx is hard and indurated it should be immediately incised. Even with early adequate drainage, osteomyelitis is a frequent complication and on no account should one await the appearance of fluctuation.

The incision is made along the lateral aspect of the phalanx, the space opened, and all the fibrous bands divided by moving the knife parallel to the bone. One should carefully avoid the flexor tendon sheath at the proximal end of the phalanx. It is also unwise to carry the incision around the end of the finger, the so-called "fish mouth" incision. This frequently causes a painful scar in the tactile pad of the finger.

In cases where drainage has been inadequate or delayed, osteomyelitis invariably follows. Here (3), as in other bones of the hand, the treatment is conservative. The soft tissue should be adequately incised and the loose sequestra removed as they separate. The curette should not be used because removal of bone in this manner may result in the destruction of healthy tissue.

PARONYCHIA

Indiscriminate treatment of "hangnails" and other minor abrasions at the base of the nail is the usual cause of infection in this area. At first it may be only a superficial vesicle along the lateral sulcus of the nail. It tends, however, to extend beneath the nail, between its base and the matrix, burrowing to the opposite side to undermine the whole root. When neglected, spontaneous drainage occurs but this is rarely adequate and soon the loose nail, acting as a foreign body, produces a chronic paronychia.

Warm, wet dressings or warm, soapy water soaks followed by simple splinting may stop an early paronychia. Superficial infections are occasionally controlled by merely incising the bleb of pus. However, it is very important to determine if there is pus under the nail

because if this is overlooked and the infected portion not removed, healing does not occur.

To treat these cases, make a longitudinal incision along the side of the nail proximally, retract the skin over the base, and cut away the undermined portion. In extensive infections, a similar incision should be made on the opposite side and the entire base removed. If this is done carefully, the nail bed is not injured and no deformity of the nail results. The distal half of the nail may be left intact for protection of the tip. After operation, the eponychium is held back for 24 hours by a piece of vaselin gauze. The same treatment is followed in chronic infections. The most common error in treating these is to be too conservative (1). All undermined nail must be removed.

COLLAR-BUTTON ABSCESS, SUBCUTICULAR ABSCESS, AND WEB-SPACE INFECTION

While these terms are not synonymous, a single case is often demonstrative of each. An infection starts under the thick skin of the palm where at first it is subcuticular, then as the pus increases it breaks through the palmar fascia in its thin distal portion to form a deeper abscess in the fatty tissue of the palm. This has been named a collar-button abscess and it is important to recognize that many subcuticular collections of pus are connected to deeper abscesses through a small opening. The deeper abscess may extend distalward into the loose areolar tissue of the web and in neglected cases will burrow to the dorsum of the hand.



An incision placed one-half inch proximal to the web and parallel to the distal palmar flexion crease affords adequate drainage. It is not uncommon to see an incision made in the web itself but they are incorrect, give poor drainage, and may heal slowly due to movement of the fingers.

1. Collar-button abscess with extension into soft tissues of proximal and distal phalanges with involvement of the web space. The extreme abduction is characteristic.

INFECTIONS OF THE TENDON SHEATHS

The synovial coverings or sheaths which cover the flexor tendons in part of their course preserve the gliding motion necessary for smooth

function of the tendon. They may become infected by lymphatic extension of infection from adjacent wounds or less commonly by puncture wounds of the sheath itself. It so happens that the sheaths of the different fingers differ in course and extent and since in few other diseases are symptoms and treatment more dependent on anatomy (1), each will be discussed separately.

Index, middle, and ring fingers.—The tendon sheaths in these digits extend from the base of the distal phalanx proximalward to a point in the palm 1 inch from the web. This blind end is termed the cul-de-sac and is the weakest point of the sheath. Pus gravitates here and rupture easily occurs. Rupture, which occurs following neglected sheath infections of the index finger, allows pus to pour into the thenar space. Extension from the sheath of the middle finger may be either into the thenar space or, more often, into the middle palmar space. The ring finger sheath also ruptures into this space. At the same time these areas become infected, the pus invades the lumbrical spaces and extends into the web to the dorsum of the hand.

The blood supply of the flexor tendons is poor and they are easily damaged by infection. When neglected, they become necrotic, a suppurative arthritis develops in the proximal interphalangeal joint, and the pus perforates the palmar fascia and skin.

To prevent this series of events and preserve the tendon, prompt diagnosis and immediate treatment is essential. This is not difficult provided the examiner keeps in mind the four cardinal signs described by Kanavel. The involved finger: (a) Is symmetrically swollen in its entire length, (b) is held in semiflexion, and (c) is markedly tender along the anatomic course of the tendon sheath, and (d) attempts to extend it cause excruciating pain. If these signs are carefully sought for and found, the diagnosis is established.

The incision is made along the radial side of the index finger and along either radial or ulnar side of the middle and ring fingers. It should be started at the distal digital flexion crease and carried proximalward to the base of the finger. The digital nerve is identified, retracted dorsally and since the blood vessels occupy a dorsal position in relation to the nerve, all structures are thereby safely removed from the operative field. The sheath is exposed along the entire length of incision. It is usually found much deeper than expected due to the edema of the tissues. If, after incising the sheath, no pus is encountered, gentle pressure over the cul-de-sac in the palm may yield a few drops of pus. Drainage of the proximal blind end is always necessary and is accomplished by a transverse incision in the palm, about 1 inch proximal to the web and parallel to the distal flexion crease.

Little finger and thumb.—The sheath of the little finger also begins at the base of the distal phalanx but as it traverses the palm, it en-

A. Acute tenosynovitis 5 days after incision and drainage. The patient was seen early.

B. and C. Healed, showing degree of function retained.



FIGURE 2A



FIGURE 2B



FIGURE 2C

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larges into a bursal sac which extends proximally beneath the transverse carpal ligament into the forearm. Under the carpal ligament the ulnar bursa contains all the flexor tendons except the flexor pollicis longus. The latter likewise begins at the base of the distal phalanx of the thumb, extends proximally into the palm and there enlarges to form the radial bursa. In most cases the two bursa communicate with one another.

In neglected infections of the radial and ulnar bursae, rupture usually occurs at the proximal end and the pus runs into the forearm. The potential cavity here is termed the retroflexor space and lies between the pronator quadratus muscle and the deep flexor tendons. Further extension may occur up the forearm, finally pointing on the ulnar side of the forearm in its proximal one-third.

The symptoms are similar to those encountered in other fingers with certain additional ones due to involvement of the bursae. Tenderness is evident all along the course of the tendon in the palm, being greatest at the point where the distal flexion crease crosses the hypothenar eminence. If the infection extends into the radial bursa, as it usually does, signs of involvement of the flexor pollicis longus appear. There is occasionally some swelling along the ulnar border of the palm and less occasionally a rather characteristic thickening limited to the wrist indicating extension into the retroflexor space. Since all the flexor tendons pass through these bursae at the wrist, the fingers are held semiflexed and extension causes pain. Marked swelling and edema of the dorsum is present. This is a part of every major hand infection, and the region is sometimes mistakenly incised in the belief that an abscess exists there.

Rupture may occur from the little finger into the middle palmar space or from the thumb into the thenar space in advanced cases. This is uncommon, however, as the tension is relieved when the pus escapes into the retroflexor space. Further neglect results in necrosis of the tendons, suppurative arthritis of the wrist, and osteomyelitis of the carpal bones.

It is not always possible to determine if an infection of the ulnar bursa has extended to the radial bursa and vice versa. In such cases, it is best to incise the doubtful area first and if it is not involved, no harm has been done. This is much better than failure to incise an infected bursa.

The sheath of the little finger is opened by an incision along its ulnar aspect. The ulnar bursa is drained by an incision parallel to the hypothenar eminence extending from the distal palmar flexion crease to the proximal part of the palm. Even though signs of retroflexor space infection are not apparent, this cavity should be opened and inspected. The incision is made on the ulnar side of the fore-

arm directly over the ulna starting at the styloid process and extending proximally for a distance of 2 inches. By starting close to the volar surface of the bone, the space may be easily entered.

The sheath of the flexor pollicis longus is opened along the ulnar aspect of the thumb. The radial bursa is drained through an incision which curves along the palmar border of the thenar eminence. The tiny motor branch of the median nerve supplying the muscles of the thenar region crosses the proximal part of the incision at right angles and extreme care must be used to avoid dividing this important structure.

In chronic sheath infections the drainage may be unduly prolonged because of necrotic tendon in the wound. Such tissue cannot regain its function and lies in the bottom of the wound as a foreign body until extruded. Healing is hastened by many months if the necrotic tendon is excised.

Prognosis in tendon sheath infections.—The outlook as regards return of function depends on several factors. With early drainage, about 80 percent return of function can be expected. The type of infecting organism also plays a part in the prognosis. The streptococcus, although more dangerous to life, is less destructive to tissue than the staphylococcus and the outlook, therefore, is better when the streptococcus is the infecting organism. Better function is obtained in thumb and little finger involvement than in the other digits because the latter infections are confined in a smaller space and are therefore more destructive. Early drainage is most important, and if this has been delayed until the tendon has been damaged, a very poor result will be obtained.

MIDDLE PALMAR SPACE

This fascial pocket lies deep in the palm, between the interosseous membrane and the flexor tendons, digital nerves, and vessels. It is bounded on its ulnar side by the fascia overlying the hypothenar muscles and is separated from the thenar space by a wall of fascia attached to the middle metacarpal bone. Proximally it extends to the carpal tunnel and distally it is continuous with the lumbrical canals between the little, ring, and middle fingers.

It may become infected by puncture wounds of the palm, by lymphatic spread of adjacent infections, or after rupture of advanced sheath infections. Extension of a human bite infection from the dorsum, through the web, lumbrical canal and thence into the palmar space (4) is a frequent cause.

Diagnosis is based on: (a) Evidence of a possible cause such as an existing tenosynovitis or a puncture wound, (b) obliteration of the palmar concavity, (c) pain on movement of the fingers which are

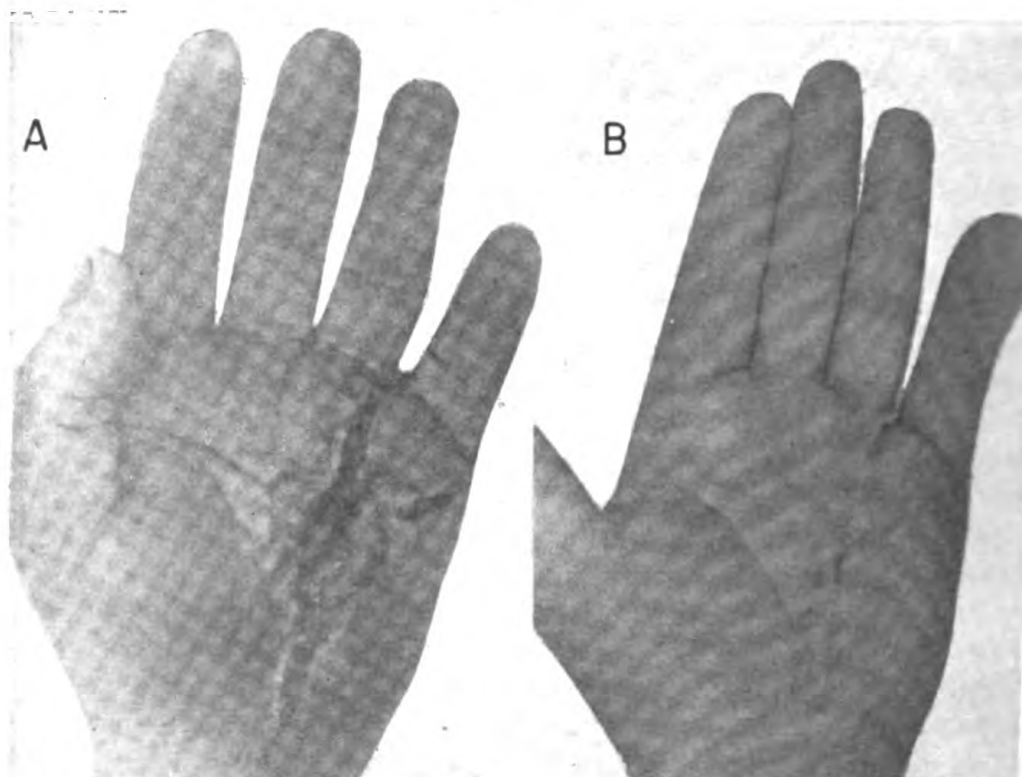


FIGURE 3

- A.** Vertical incision in the palm for drainage of middle palmar space and lumbrical canal
- B.** Healed. The scar is very tender. Incisions in the palm should be made transversely, parallel to the flexion creases.

held in a semiflexed position, and (*d*) a hard, indurated palm, tender on palpation. No definite swelling occurs due to the dense palmar fascia. There is marked edema of the dorsum of the hand.

This space is opened through a transverse incision along the distal palmar flexion crease. Since it lies deep to the nerves and tendons, these structures must be carefully avoided.

DORSAL SUBCUTANEOUS AND SUBAPONEUROTIC SPACES

Attention has already been directed to the frequency with which swelling of the dorsum occurs in hand infections. Although uncommon, collections of pus may occur in two spaces in this region. The most superficial of these, the dorsal subcutaneous, is of minor importance. The deeper one is a potential space which exists beneath the aponeurosis of the extensor tendons. It is most frequently infected through extension of pus from the palm via the lumbrical canals into the web where it ultimately escapes dorsally to the sub-

aponeurotic space. Collections of pus here are difficult to detect. The marked edema of the subcutaneous tissues and the taut aponeurosis prevent fluctuation and can hide a large abscess.

Drainage is secured by a simple, longitudinal incision starting at the metacarpal heads and carried toward the wrist for 2 inches.

DIGITAL SUB-FASCIAL INFECTIONS

One frequently sees a deep, rather extensive infection in the fingers which lies beneath the thin digital fascia and tends to spread both proximally and distally along the finger. The finger itself is diffusely swollen, and may simulate a sheath infection but without the exquisite pain on extension nor the tenderness limited to the tendon sheath. If neglected, however, the latter may become involved.

Drainage is obtained through an incision on the lateral aspect of the finger. It is not uncommon to find nearly half the digit enveloped in pus.

HUMAN BITE INFECTIONS

Here the infecting agents are the fusiform bacillus and Vincent's organism which, with various secondary invaders, produce the most damaging infections of the hand that are seen. A small, innocent-appearing wound on the knuckle, usually the result of a fist fight, becomes painful in 1 to 2 days, foul-smelling in another 5 to 7 days and months later, in spite of careful surgical treatment, one or more joints are ankylosed, osteomyelitis has destroyed part of the bone, the flexor tendons may have been extruded, and the patient has a stiff, permanently disabled hand.

At first the inflammation remains localized in the area of the knuckle but soon begins to spread through definite anatomical planes as shown by the careful study of Mason and Koch (4). Extension can occur proximally under the dorsal aponeurosis and also distally beneath the extensor tendon, thence to the volar side of the finger and through the lumbrical canals to invade the deep spaces of the palm. The middle palmar space becomes infected and occasionally one of the flexor tendon sheaths. A high percent of human bite infections seen late (2 or 3 days after injury) will extend in this manner despite treatment so it is necessary to examine the palm for tenderness every day at each dressing.

The treatment for superficial human bite wounds consists in careful debridement and immobilization on a splint. They should not be sutured. Inability to extend the finger indicates that the extensor tendon has been damaged with probable contamination of the joint and is a very serious prognostic sign. Suppurative arthritis and osteomyelitis of the adjacent bone occurs almost invariably. For this reason it is wise to hospitalize such cases for a few days, keep the

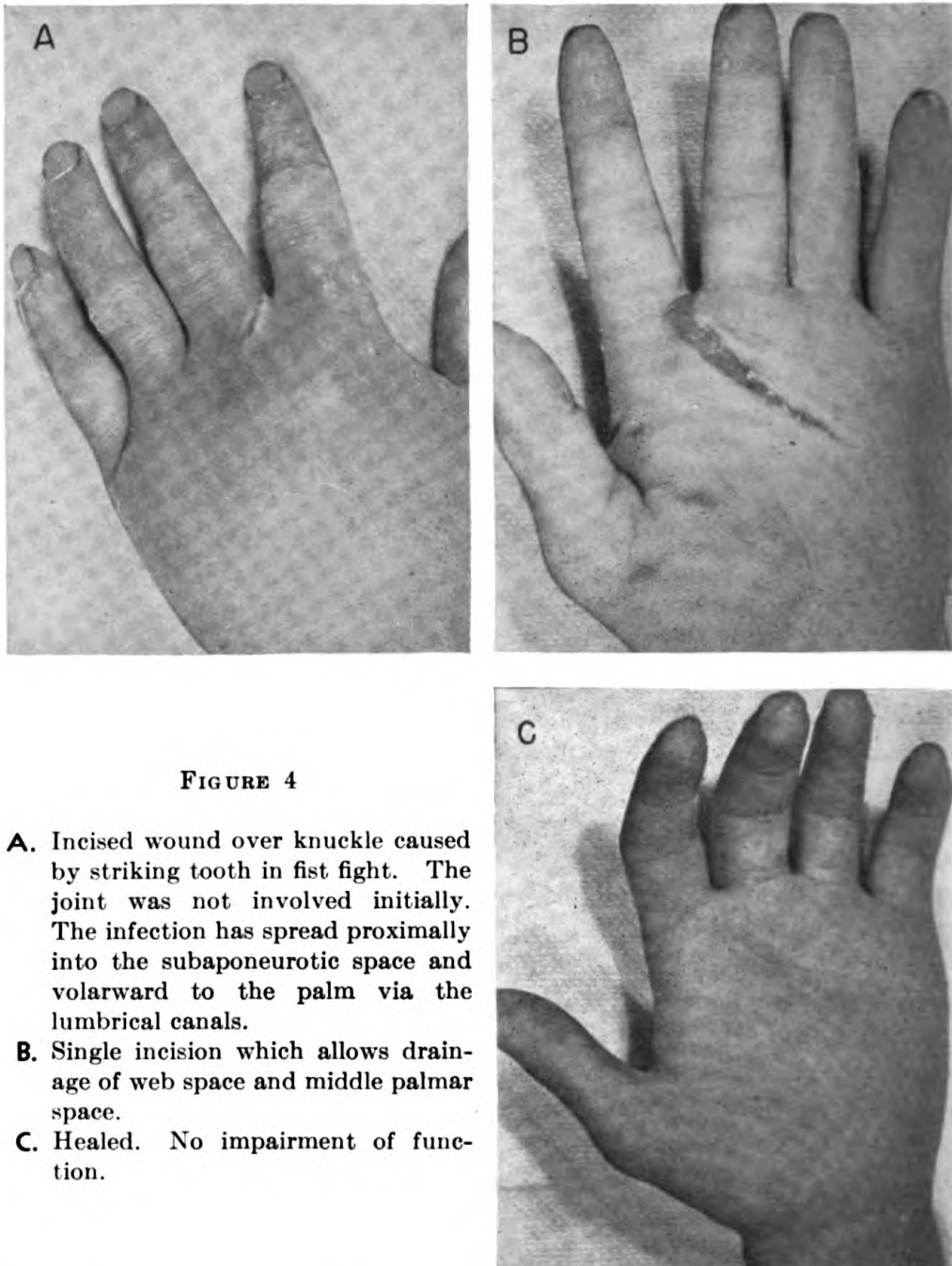


FIGURE 4

- A. Incised wound over knuckle caused by striking tooth in fist fight. The joint was not involved initially. The infection has spread proximally into the subaponeurotic space and volarward to the palm via the lumbrical canals.
- B. Single incision which allows drainage of web space and middle palmar space.
- C. Healed. No impairment of function.

hand in a warm, moist dressing, give 20,000 units of penicillin intramuscularly every 2 hours and observe carefully for extension. In fulminating infections with a marked systemic reaction, x-ray therapy is helpful, but should be administered cautiously and only by a roentgenologist.

In late foul-smelling wounds, all necrotic tissue should be excised. Zinc peroxide is helpful if used properly (5). The powder is mixed with sterile water to obtain a creamy suspension and introduced into

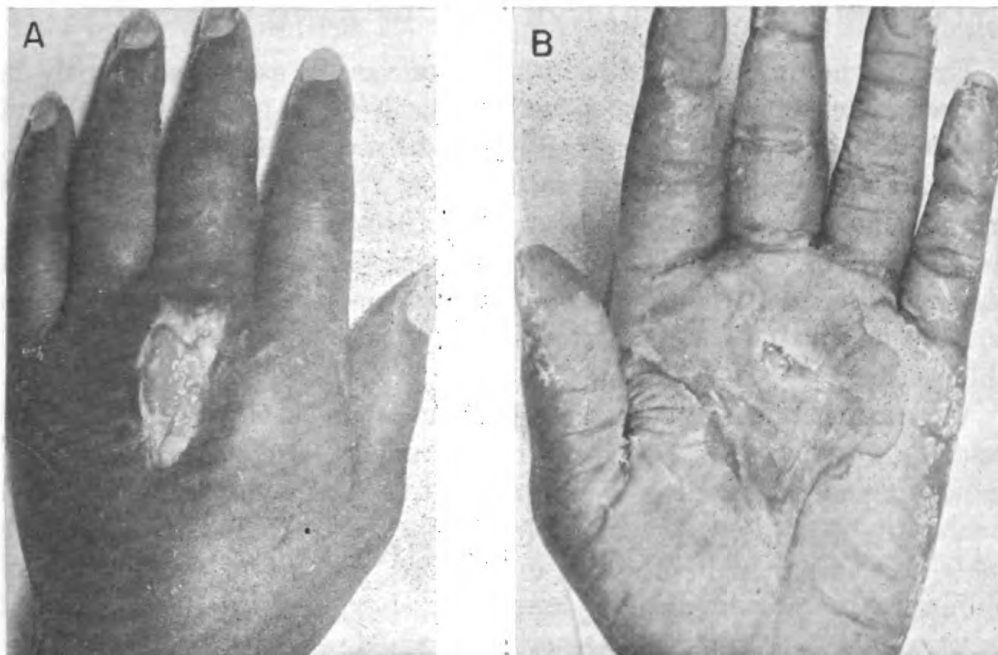
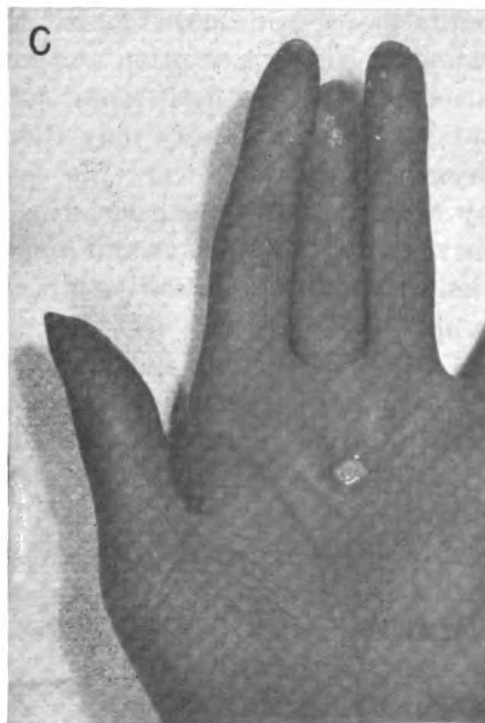


FIGURE 5

- A.** Human bite infection seen late. The joint was opened by the tooth and now the patient has suppurative arthritis, osteomyelitis and extension of the infection into the palm. The wound is very foul-smelling and necrotic extensor tendon can be seen.
- B.** Three weeks after drainage of the middle palmar space. The wound is partially healed and is assuming the appearance of a chronically draining sinus. The flexor tendons, which were involved in the process, are now necrotic and must be removed before healing can occur.
- C.** End result. A painful, permanently crippled hand with loss of flexor tendons, osteomyelitis of third metacarpal and ankylosis at the metacarpophalangeal joint. Note shortening of middle finger due to loss of bone. These are the most destructive infections seen in the hand.



all parts of the wound which is then sealed by covering with several layers of vaselin gauze. The dressing is changed daily and all of the zinc peroxide instilled the previous day is carefully removed. This is important as otherwise the preparation will cake in the wound and block drainage. Dakin's or 1 percent chlorazine solution is useful to obtain separation of necrotic tissue.

GENERAL POSTOPERATIVE CARE OF HAND INFECTIONS

Drains should consist of light strips of vaselin gauze laid gently in the wound. Their only purpose is to keep the skin edges apart and should not be packed in so tightly as to impede the escape of pus. Coarse rubber tubing must never be used. Such heavy material does irreparable damage to the delicate structures of the hand. Likewise, as Kanavel (*1*) says, "There is no place in the hand for through and through drains." To brutally thrust a drain from the palm through to the dorsum only demonstrates a surgeon's complete ignorance of the anatomy of the hand.

Various chemical agents have been used in the aftercare of these infected wounds. Although surgical drainage is certainly the paramount consideration for effective treatment, the sulfonamides and penicillin have proved very useful in the early stages. They have little if any value in chronic infections. The local application of sulfanilamide powder has not materially shortened the healing period in cases which have been adequately drained.

After incision, the hand is placed in a sterile dressing composed of many pieces of unfolded gauze, the whole moistened with physiologic saline or Ringer's solution and held together by a sterile towel. The incorporation of a light metal splint in the dressing assures immobilization. The extremity may then be placed in a heat cradle and the dressing moistened every few hours with physiologic saline solution by opening the outside covering. Such a dressing is usually necessary for only a few days and longer use may result in harmful maceration of the skin. Likewise, drains should be removed as soon as the suppuration decreases lest they retard healing.

Later care consists in soaking the extremity once or twice daily in warm, soapy water, keeping the wound clean and carefully debrided, dried in sunlight or under an electric light, and finally dressed with sterile gauze and splinted. If the wound contains debris or a necrotic eschar which does not separate, Dakin's solution is useful.

Each dressing should be changed solely by the use of sterile instruments and great care used not to add bacteria from without nor to contaminate the fingers. After observing these precautions, it is certainly illogical to advise the patient to go home and soak the hand, dressing and all, yet this advice is frequently given.

It must constantly be borne in mind that the purpose of all treatment is restoration of function. At each soaking, the hand and fingers should be moved through the greatest range of motion that does not cause pain. During the course of the infection when immobilization is required, it should be in the "position of function," wrist dorsi-flexed, fingers flexed, and thumb abducted from the palm.

This position allows the greatest function in the event all mobility is lost.

Finally, active motion is more effective than passive motion and the patient must be made to realize that in the last analysis, it will be he alone, through his own diligent massage and exercise, who dictates the final result.

REFERENCES

1. KANAVAL, A. B.: Infections of the Hand. 6th edition revised. Lea & Febiger Co., Philadelphia, 1933.
2. KANAVAL, A. B. and MASON, M. L.: Infections of the hand, in *Cyclopedia of Medicine, Surgery and Specialities*, G. M. Piersol, editor. F. A. Davis Co., Philadelphia, 1939.
3. KOCH, S. L.: Osteomyelitis of the bones of hand. *Surg., Gynec. & Obst.* **64**: 1-8, January 1937.
4. MASON, M. L., and KOCH, S. L.: Human bite infections of hand, with study of routes of extension of infection from dorsum of hand. *Surg., Gynec. & Obst.* **51**: 591-625, November 1930.
5. MELENEY, F. L.: Zinc peroxide in treatment of micro-aerophilic and anaerobic infections, with special reference to group of chronic, ulcerative, burrowing, non-gangrenous lesions of abdominal wall apparently due to micro-aerophilic hemolytic streptococcus. *Ann. Surg.* **101**: 997-1011, April 1935



LICHENOID DERMATITIS

So-called "Lichenoid dermatitis" is a chronic dermatosis, occurring among personnel stationed in the South Pacific area and other areas where atabrine is administered in relatively large amounts for long periods of time. It begins with eczematous lesions on the dorsal surfaces of the extremities, which soon develop into either chronic eczematoid lesions, lichen planus-like lesions, or both types of lesions. In some cases large body areas or even the whole body surface becomes involved. Any type may go into a generalized exfoliative dermatitis. The principal cause of the condition is held to be atabrine, although dietary deficiency, climatic and other environmental factors and photosensitivity may play important roles. The dermatosis is easily diagnosed from its clinical appearance, its history of drug administration, and its characteristic histopathology, which resembles lichen planus chiefly, and to a lesser degree, psoriasis. The prognosis for life and for cure of the acute lesions is excellent, provided the patient is evacuated from the tropics. The treatment is symptomatic dermatological care, except that large doses of Vitamin B complex are reported to hasten healing. The disease generally clears up in 6 to 12 weeks after evacuation to the United States.—BERESTON, E. S.: Lichenoid dermatitis. *J. Invest. Dermat.* **7**: 69-83, April 1946.

THE ROLE OF THE PSYCHIATRIST IN THE NAVAL DISCIPLINARY BARRACKS

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To understand and evaluate the role of the psychiatrist in the Naval Disciplinary Barracks it is necessary to have an adequate estimate of the function and role of this naval institution itself. And it is well to bear in mind also that whenever one considers the milieu in which the psychiatrist does his work one must also be cognizant of the predominant emotional and attitudinal milieu as it is expressed by the medical and nonmedical associates in his immediate environment. This is particularly pertinent in relation to a correctional or penal institution and is of *primary* importance when one is dealing with an institution that must be at one and the same time custodial, disciplinary, eliminative, and rehabilitative. And these many functions that the disciplinary barracks itself must carry out day by day and the emphasis placed on one or the other of them will be determined in turn, by the attitudes held by the individual psychiatrist himself and his associates relative to the future value or lack of value to the naval service of the prisoner himself.

The Naval Disciplinary Barracks is the "ultima ratio regis"—the "last argument" of an exasperated and sorely tried naval service. The population of the Naval Disciplinary Barracks and its counterpart in the Army, therefore, probably represents the purest strain of nonconformity and maladjustment of young men in the post-adolescent age group that one can obtain anywhere. Viewed as objectively, as scientifically, or as medically as one can, this population by its manifest desertion of its duty to the nation in peril can (if we are not careful) arouse in us feelings of resentment and aggression. That just such an attitude is held today by some of the nonmedically trained is not at all surprising. Nor is it surprising that measures taken (or not taken) relative to the rehabilitation and re-education of these men may be determined in large part by our feelings and attitudes concerning these men *as a group* rather than by scientific evaluations of the individuals comprising the group. And I would emphasize that the psychiatrist may be just as vulnerable to such swings in attitude concerning the naval (or even intrinsic) worth of the men under his care as is the most ardent disciplinarian.

In short, the psychiatrist in the Naval Disciplinary Barracks attempts to play the role of the medical man who is interested in cor-

rection, amelioration, or elimination of the problems of the *individual* man and he must play this role in a milieu set up to administer justice and mild discipline to a group *as a group*, the offense in 99 percent of the cases being the same, i. e., that without authority they left their appointed places and went elsewhere to follow their own desires and wishes regardless of the harm their defection might cause their country or their colleagues. For this they are punished by loss of liberty and within the limitations set up by naval law the psychiatrist must demonstrate that he has something to offer in the care, treatment, and disposition of these men that will be of help to the naval service and to the naval personnel involved.

At the outset, however, it should be stated, I think, that the greatest mistake that can be made by the psychiatrist in a military correctional institution is for the psychiatrist to assume that he can practice his profession as it is practiced in civilian life. Continued and exclusive interest in the individual alone, or even as a major emphasis, by the psychiatrist in the military service of a nation (and particularly if the nation be at war) would seem to me to be the most startling evidence of lack of adaptability on the part of the psychiatrist himself. Naturally he does not have to set aside his ideal of practice but he certainly must, for the time being, be content with only a rough approximation to that ideal. Otherwise his effectiveness will be entirely lost and he himself will be miserable.

However, one can, I believe, outline five functions or areas of function assumed or covered by the psychiatrist in the Naval Disciplinary Barracks at the present time. These five functions are in the order of importance and involvement of time: I. Diagnostic; II. therapeutic; III. forensic; IV. educational; and V. research. We shall deal with these five functions in detail.

I. The most important present-day function of the psychiatrist in the Naval Disciplinary Barracks is diagnosis and the suggestions for disposition made on the basis of this diagnosis. In short, the psychiatric department of a Naval Disciplinary Barracks can be considered one of the best examples extant of an outpatient psychiatric "clinic"—a clinic in which all men should be seen at least once in a diagnostic interview by a psychiatrist or by a well-trained clinical psychologist or psychiatric social worker, the work of the latter two groups to be supervised and reviewed by the psychiatrist himself in staff conference.

At the present time, the routine plan in most Naval Disciplinary Barracks is as follows: Upon entrance to the Naval Disciplinary Barracks, whether first offenders or not and regardless of what action they are awaiting, duplicate entrance sheets with the man's name, rate, and offense are sent to the psychiatrist. These men are seen in

diagnostic interview and are tested by group test and by additional individual scales if group test results seem to warrant it. On the basis of these preliminary examinations a man may be referred to the out-patient division of the naval hospital for a more detailed neurological examination or for an electroencephalogram. When all data thought necessary to make a psychiatric diagnosis are gathered on the individual man, the entrance sheet is filled out stating whether the man is: (a) Psychopathic and hence is being sent into the naval hospital for consideration for medical survey; (b) normal, nonepileptic, non-feeble-minded, and hence ready for trial; or (c) ready for trial with the opinions and recommendations of the psychiatrist. Here the psychiatrist can include findings on the man pertinent to responsibility, mitigating circumstances in man's family or previous life that he thinks would be of interest to the commanding officer, recorder, or to the judge advocate. The filled-out entrance sheet is sent immediately to the disciplinary officer concerned for his information and forwarding. By this procedure the psychiatrist has taken from the trial list the feeble-minded, the epileptic, the obviously psychopathic, the sex offenders, and the rare psychotics that are found in the Naval Disciplinary Barracks population. The time and expense involved in trial is saved and the man is well on his way to be eliminated from the service as mentally unfit, unadaptable, or undesirable. If the hospital or the body reviewing a recommended survey disagree with the psychiatrist's opinion of a prisoner he can be tried directly following his return from the hospital.

I think it is a pertinent digression at this point to suggest that much time and expense (and also many needed hospital beds) would be saved if the Naval Disciplinary Barracks psychiatrist and his clinic team (psychiatrist, psychologist, and social worker) could present their material on mentally unfit cases to a survey board meeting periodically in the disciplinary barracks to consider such cases rather than following the costly and time-consuming routine of sending a man to occupy a hospital bed for 2 or 3 weeks (sometimes for months) under "observation." Certainly such hospitalization is probably not necessary in the feeble-minded and epileptic group though it will still be necessary in the questionable or borderline cases.

As can be seen from the foregoing, the diagnostic role of the psychiatrist in the Naval Disciplinary Barracks, is, for the most part eliminative, aimed at the necessary discharge from the service of all those whose poor mental condition or characterological defects (constitutional or acquired) are of such a type and severity as to render their future contribution to the naval service very questionable or definitely harmful. But even in these cases it can be the beginning of a rehabilitative procedure if the man himself is advised as to where

he can receive help in his home community and if the home community is informed through social service agencies, notably the Red Cross, that the man is being returned to civilian life and will need all the help that local rehabilitation programs can offer. To see that responsible bodies in the local communities are notified of the psychiatric needs of a returning sailor can be considered one of the functions of the disciplinary-barracks psychiatrist.

Now it might be well for a moment to consider sources of "material" or the means of referral of patients to the disciplinary barracks psychiatrist other than through the routine entrance sheets mentioned previously. As Naval Disciplinary Barracks are constituted and operated at the present time a considerable proportion of the prisoner population may be transferred to a particular disciplinary barracks after trial. These are men serving sentence and in many instances they have not been screened psychiatrically since they first evidenced difficulty in adjusting in the service. There are four ways in which these men can come to the attention of the psychiatrist for a diagnosis.

First, they most frequently and most easily come under the observation of the physician at daily sick call. The nature of the complaint, the method of presentation of symptoms, or the repeated appearances of the man at the sick call, all tend to arouse the interest of the psychiatrist and the man is given an appointment for a diagnostic interview in the psychiatric department.

It is the opinion of the author that the psychiatrist himself should hold daily sick call (procedures vary in various disciplinary barracks, depending on their size and personnel) but if he does not, certainly he should attend sick call in the company of the physician primarily responsible for the physical care of the men. For it is only in this way that many men who may be missed during routine examination, or those who develop a psychoneurosis or psychosis during their incarceration, will be discovered and referred for diagnosis or treatment. The superimposition of the frustration attendant upon being sentenced and imprisoned may in itself be just enough to cause a mental break in a man who previously appeared normal. Or the "defenses" (physical or mental) that he brings to bear at such times may be so extreme as to render him abnormal, i.e., definitely psychoneurotic or psychotic. And he is more than likely to appear before the doctor at sick call for help.

A second source of case material is the referrals from the disciplinary barracks chaplain. Men who are troubled by their own inner conflicts, or who are troubled by personal and material conditions in their homes, both of which may have led directly to the offense against naval discipline with which they now stand charged, bring such problems to the chaplain and ask for his opinion and guidance. As

a matter of fact, after many months of very close association and collaboration with the work of chaplains on duty in a Naval Disciplinary Barracks, I am convinced that 90 percent of the problems referred to him by the men (as contrasted with the remaining 10 percent which are concerned with spiritual matters) are problems that definitely call for the ministrations and advice of the trained social worker and particularly of the trained psychiatric social worker.

Most chaplains are aware of the psychiatric significance of many problems, or of certain constellations of symptoms, both of which immediately tell him that the case is a medical one and the man is to be sent forthwith to the psychiatrist for diagnosis. However, the psychiatrist should not lose sight of the necessity for counseling with the chaplain in order that the latter will have a clearer idea of the psychiatrist's concern and interest.

Third, the commanding officer, the line officers, or the guards oftentimes will be the first to notice an apparent mental deviation in those men who do not enter the disciplinary barracks before their sentence and hence miss the routine psychiatric check. More than this, the aforementioned line officers and guards are in the best positions possible to first note abnormalities because they have the men under close observation at drill, in classes, on working parties, during recreation periods, or in the various prisoner compartments. The psychiatrist does get referrals from these men. He undoubtedly gets more of them when the guards are well chosen for their ability to handle men and when the psychiatrist makes known to them that certain difficulties in discipline and in the administration of it can spring from underlying conflicts that call for psychiatric help. The guards must be made aware of the facilities and functions of the psychiatric department if it is to be expected that they use it properly and enough.

Fourth, and finally, the routine psychometric (group) examination of all men entering the disciplinary barracks, whether they are to be tried at the present activity or whether they already have been tried, will enable the psychiatrist to eliminate the feeble-minded individual, assuming, of course, that the man's past academic, work, and social histories corroborate the suspicious findings of the standardized test. Also, every man whose I. Q. by group test is found to be below 70 should be re-tested in the psychological department with an individual intelligence test such as the Bellevue-Wechsler scale. Together with these a psychiatric diagnostic interview is secured and recommendations advanced.

II. (a) The psychotherapeutic role of the psychiatrist in the Naval Disciplinary Barracks at the present time is a rather limited one. Surely he does his best by *vis a vis* psychiatric interview to aid

the men who come to him for help. Also, he is able to select from the sick call all the cases he can possibly see in the time available for such work. But he definitely cannot make therapy his major function. This is true not only because of the limited number of hours per week that can be devoted to this work with the individual man but it is also limited by the length of time the men themselves are under the restriction of the disciplinary barracks. Many of the men are in the disciplinary barracks for sentences of 5 to 10 or 30 days, some are there only until tried, some come after trial, some are in close confinement, bread and water cases, etc. Finally, long term cases usually are not kept in such institutions but are transferred to the naval prison after a short stay in the disciplinary barracks.

On the other hand, fruitful and worthwhile individual psychotherapeutic work can be done with cases exhibiting: (1) Hysteriform types of reactions; or (2) mild reactive depressed states, both of which are sudden reactions against the dawning fact of the "awfulness" and seemingly interminable length of the imprisonment ahead. These reactions are usually seen early in the prisoner's stay and they usually take the anxious, conversion, or agitated forms. (A transient paranoid type of reaction is very much less in evidence among these men.) These men can be helped by the psychiatrist and the help given in relation to these attitudes in the early stage of imprisonment may have considerable effect on their later naval service when their sentence ends and they are restored to duty.

(b) The most effective type of psychotherapy that can be used in the disciplinary barracks is group psychotherapy. Lectures and discussion on personal problems that are to be faced by all men, discussion of naval usages and customs, lectures on the aims of the nation and the service in war and in peacetime plus the role of the individual in carrying them out, all can aid in returning the offender to duty with a different and worthwhile attitude to the service and in respect to his own individual worth. Movies, reading, posters, and radio programs all have a supplementary part to play in this group therapy.

All such group therapy, if it is to succeed, must be given to smaller, more or less homogeneous groups within the prison population. Selection of groups as to more or less the same criteria (age, I. Q., number of offenses, and length of sentence) will make group work more effective. The selection of the groups, the methods of presentation and the "course contents" should be the joint result of close collaboration between the psychiatric, psychological, and educational officers of the activity.

(c) A third type of therapy that is carried out in the disciplinary barracks is remedial therapy for nonreaders or borderline illiterates.

Every disciplinary barracks of 500 or more men will have in it a group of otherwise mentally normal men who have never had the opportunity to learn to read or who, having the opportunity to learn, could not take advantage of it because of the existence of a technical reading disability. In most instances in these particular cases, the inability to read contributed at least indirectly to their difficulties in the Navy and in some of the cases it was the direct cause of their infraction in that they could not read muster rolls, transfer lists, and rules and regulations. These men will probably make acceptable members of the naval service once they have learned to read and they are eternally grateful for the interest and help given them. Naturally all of the remedial work is directed at the man's naval service and the reading material is drawn from the words and phrases that the man will encounter in his service period. To this group of illiterates are added those men who themselves feel that they should have added training in reading even though they may have second and third of fourth grade learning ability.

III. A third role of the psychiatrist in the Naval Disciplinary Barracks is best called his "legal" or "forensic" role in that it has to do with his functions as a specialist on human behavior as it concerns the administration of naval law. We have already cited the necessity for pretrial psychiatric examination of all men entering the disciplinary barracks. To this function also is added the periodic conferences with the disciplinary officer in "borderline" or questionable cases, the presence of the psychiatrist for the defense or for the prosecution when the question of "sanity" or "responsibility" has been raised, the evaluation of cases selected by the commanding officer at captain's mast to aid the captain in determining whether the case in hand is a disciplinary or a medical one. Finally, his opinion is sought by boards dealing with clemency or recommendation for restoration to duty of offenders previously awarded bad-conduct discharges. All of these "forensic" functions should be carried out by the psychiatrist in each disciplinary setting. Needless to say, for this work it is necessary for the psychiatrist to equip himself with the minimum adequate legal knowledge by taking the naval correspondence course in military law.

IV. All of these functions of the psychiatrist, diagnostic, therapeutic, and forensic lead directly to a fourth function, the educational. We do not mean by this the education of the prisoners, for that is the role of the educational officer of the activity. But the psychiatrist's educational role to which I refer here is in the training of the men associated with him to a realization of the significance of some types of human behavior, i. e., the significance of such behavior relative to the abilities and responsibilities of human beings for their

acts and their value as harbingers of the individual's probable future worth as a serviceman or as a citizen. The significance of aggression, the question of responsibility, the reactions to frustration, the desires and needs of men whether in the service or out of it, these have to be particularly stressed and re-emphasized with all personnel delegated to guard and care for the naval prisoner with the ultimate aim that all dealings with the prisoner will have as their goal the rehabilitation and return to conscientious duty of all men who are by personality endowment capable of so returning, and returning with an attitude concerning themselves and the service that should make for success as a serviceman. One of the most lasting and worthwhile functions that the psychiatrist can carry out will be found to have been just this one I am now stressing, the education of his non-medical naval associates in a few simple but nonetheless fundamental psychiatric concepts.

V. Finally, the psychiatrist in the disciplinary barracks has another, perhaps minor, but nevertheless important function and duty, the duty to do research in that particular branch of psychiatric work in which his superiors placed him. He should amass data, and with it control data, in order that some light shall be shed on what types of individuals can and do succeed in the Navy as contrasted with those who become chronic naval misfits and failures with the great losses in money and time that the acceptance or reinstatement of such men entail. The psychiatrist in the disciplinary barracks can and should work out predictive schemes and probabilities that will enable the naval enlistment bodies to eliminate (insofar as it is humanly possible to predict) those men who we now see in the finished product of the chronic offender. Such studies aimed at the better selection and retention of men must be continuous as in the case of our colleges and universities where data are constantly being collected and evaluated. Our country is going to need a large and efficient Navy for many years to come and the problem of personnel selection will still be one of the greatest problems to be faced. The psychiatrist in the disciplinary barracks should make his contribution to this all-important problem of selection through pointing out definitely through established scientific methods the type of man the Navy does not want, ever.

Finally, the psychiatrist at all duty stations can be of considerable aid to his country if he turns the spotlight upon himself and upon his own specialty to determine, insofar as he can, what kind of a role he should play in the various naval activities to which he may be assigned not only for the performance of creditable duty at some possible future date but to better enable the medical-officer procurement branch to select and assign psychiatrists in some distant struggle

that may befall the nation years hence. The necessary training background for psychiatrists in their particular type of work, the role of the clinical psychologist, and the need for trained psychiatric social workers are all problems which are important to the Bureau of Medicine and Surgery and an elucidation of beneficial and feasible plans regarding them are a part of what might well be termed the "research function" of the psychiatrist assigned to all naval establishments at the present time, including the activities designed to care for disciplinary cases.

In summary, I have outlined the present functions of the psychiatrist stationed in the Naval Disciplinary Barracks with a few hints as to how he might possibly function better in the future. In conclusion, it should be stated again that the activity which we are considering here is not a psychiatric pavilion, nor should it be looked upon as such, but it is a disciplinary barracks where within the limitations set by such a correctional institution the psychiatrist functions. In carrying out these multiple functions, he will have the happy privilege of bringing to bear on this whole problem all of the advances in knowledge that comprise the fundamental bases of modern psychiatry and penology.



SCABIES AND PEDICULOSIS TREATED WITH BENZYL BENZOATE, DDT, BENZOCAINE EMULSION

Authors' Summary and Conclusions.—"1. Benzyl benzoate emulsions, introduced by A. Kissmeyer, constitute an improvement over most older measures of antiscabietic treatment.

"2. A further increase of effectiveness, reduction of stinging and of irritations has been achieved in NBIN emulsion developed by G. W. Eddy of the United States Department of Agriculture (mixture of benzyl benzoate, DDT, and benzocaine in an emulsion of "Tween 80" and water).

"3. One to four sprayings with this clean and easily applied emulsion produced permanent cures in 41 of 42 patients. In most cases a single spraying sufficed.

"4. A single application of the NBIN emulsion was effective also in curing 15 cases of pediculosis pubis and 4 cases of pediculosis capitis.

"5. In the present cases there were no evidences of toxicity and no increase of skin irritancy. The preparation was easier and more pleasant to use, and less irritating than older measures used against scabies and pediculosis.

"6. Further clinical studies are required to confirm the lack of toxicity of DDT when used on large series of persons in emulsions such as NBIN"—CARPENTER, C. C., HEINLEIN, J. A., SULZBERGER, M. B., and BAER, R. L.: Scabies and pediculosis treated with benzyl benzoate, DDT, benzocaine emulsion; including a comparison with other methods, etc. *J. Invest. Dermat.* 7: 93-98, April 1946.

CONDITION SIMULATING APPENDICITIS FOLLOWING CHOLERA VACCINE INOC- ULATION

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The limited medical literature at this station does not record the observation that has been made recently upon a repair ship in the Pacific. It is felt that the findings are sufficiently interesting to note, in view of the fact that there existed a condition in a large group of men in which the differential diagnosis between a surgical and a medical condition had to be made, since most of the cases showed clinically a rather typical appendicitis.

Eleven hundred men aboard ship were given bacterial vaccine made from cholera vibrios, 8,000,000,000 per cc., receiving subcutaneously $\frac{1}{2}$ cc. at the initial injection, and 1 cc. on the eighth day following. From 2 to 5 days after receiving an inoculation, a total of 38 men developed symptoms and signs suggesting an inflammatory process in the region of McBurney's point. The symptoms in order of prominence and frequency consisted of abdominal pain in the right lower quadrant of the abdomen or in the region of the umbilicus (a few also had epigastric or left lower quadrant pain), diarrhea, constipation (or both, alternating), vomiting, headache, and several had symptoms of a mild upper respiratory infection. The temperature was elevated from $\frac{1}{2}$ to $1\frac{1}{2}$ degrees in practically all cases.

Examination revealed abdominal tenderness, at McBurney's point or slightly medial to it, and also in the epigastrium or left lower quadrant in several cases. Muscular rigidity was infrequent and was only slight when present. Right-sided rectal tenderness was a constant finding, with tenderness also on the left in the cases showing abdominal tenderness in the left lower quadrant.

The symptoms and signs persisted for 3 to 16 days following the onset, with an average of approximately 7 days.

The leukocyte count was 9,000 to 11,600 in 30 of the cases, being 13,300 in 1 case, and 8,000 to 9,000 in 7 cases. The average was approximately 10,000. In the cases in which a differential count was made there were no unusual changes. A sedimentation rate was done in 7 men, with a result of from 5 to 14 mm. in 1 hour, the average being 9 mm. The urinalysis revealed no abnormal findings. Stool

examinations were made in only a few cases (those having diarrhea), and the findings were negative except for the presence of mucus.

Twenty of the cases occurred following the initial inoculation, and 18 after the second. Those men showing the condition after the first inoculation did not have an increase in subjective or objective findings following the second injection, although the second was withheld from about one-third of these men.

Appendectomy was performed early on 3 men in the group, before the apparent relationship with the cholera inoculation became manifest. These cases showed grossly that there was only a slight appendiceal inflammation in 2 of the cases, being rather a peri-appendicitis and hardly greater than that present in the cecum and terminal ileum. The third case had a marked injection and edema of the appendix. All the cases revealed a marked mesenteric lymphadenitis. No facilities were available for pathological examination of the tissues microscopically.

Two of the men in the group had had a previous appendectomy, which further suggested some other etiological factor or pathological condition present.

Since this episode has occurred it has been learned by verbal communication with a few other medical activities that similar observations had been made. In one instance, in a small group of men, practically all the men developed a moderate to a severe diarrhea lasting several days, with its onset a few days after the cholera inoculations were made.

It is believed the above-described condition has been a result of the cholera vaccine inoculation.



CEREBROSPINAL FLUID IN TYPHUS FEVER

The author conducted a study of spinal fluid in typhus fever. After the puncture has been performed, patients become quieter, would fall asleep and at times there has been drop in temperature. In all cases spinal fluid pressure was increased; albumin fluctuated between 16 mg. and 82 mg./100 ml. and cell count between 30 and 100/ml. From the examination of spinal fluid the author concludes that serious meningitis accompanies typhus fever. He also studied sugar, chlorides and vit. C. After study of 37 patients, he concluded that vit. C is diminished and sometimes absent in spinal fluid of typhus fever patients. The same diminution of vit. C was found in blood. These findings suggest necessity of administration of vit. C in cases of typhus fever.—KAREMOV, C. M.: Cerebrospinal fluid in typhus fever. *Biological Abstracts* 20: 700, April 1946.

EYE INJURIES IN AMPHIBIOUS WARFARE¹

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The type of eye injuries encountered in amphibious warfare of necessity differs greatly from those seen in the usual civilian ophthalmological practice. In an article so brief as this it is impossible to go into the many reasons why the above statement is true. The more common injuries encountered will be briefly discussed and other treatment briefly described with the idea that something may be learned that will help in treating injured eyes.

The most common eye injury observed has been foreign body of the cornea and conjunctiva. Often this condition is handled poorly, especially if the foreign bodies are from a land mine and embedded in the tissues. The treatment of this condition is removal of foreign bodies as soon as possible. The eye should be anesthetized with pontocaine or butyn solution, and with a spud or cataract knife, under good illumination, the bodies should be removed. In cases where there are a great many deeply-embedded foreign bodies of both corneae, I remove only four or five from each eye the first day. A drop of 1 percent atropine solution and a drop of sterile mineral oil or castor oil is then placed in each eye, and the eye bandaged firmly until the following day when a few more are removed. In cases where there are thirty to forty foreign bodies in both corneae it may take 4 days to remove them all. If many deeply embedded foreign bodies are removed at one operation the eye becomes greatly congested and iritis often follows. Foreign bodies of the conjunctiva often can be removed by small forceps or by excising a small piece of conjunctiva immediately surrounding the foreign body with scissors. All of these types of injuries should have 1 percent atropine sulfate solution instilled daily as long as there is any ciliary injection, and a firm bandage placed over the eye if any foreign bodies remain. It is often advisable to give 25 million organisms of typhoid vaccine intravenously for its foreign protein reaction in these cases.

The next most common eye injury is laceration of the globe, whether it be corneal or scleral. In laceration through the cornea

¹ Read in December 1944, before a large group of medical officers serving with Amphibious Forces, Pacific.

there is always some loss of aqueous humor with varying amounts of prolapse of the iris. The eye should be anesthetized locally and the prolapsed iris excised. The conjunctiva at the limbus should be dissected free for 1 centimeter back and a purse-string suture placed through the free edge of the conjunctiva. The suture is tied, which pulls the loose conjunctiva over the laceration and offers a support to the lacerated eye, prevents further loss of aqueous humor, and gives the laceration a chance to heal. The eye should be atropinized and a firm bandage applied. Usually within 8 to 10 days the suture falls out and the laceration of the cornea is healed. If the laceration is mostly in the sclera the conjunctiva is dissected away from the laceration and from one to three fine sutures placed in superficial layers of the sclera and the edges of the wound approximated. The conjunctiva is then sutured over the sclera wound, atropine instilled, and a firm bandage applied. All of these cases should be x-rayed to determine whether a foreign body is present inside the globe.

Laceration of the lids is quite common and it is important that they be properly treated to prevent deformities as well as to restore their physiological function. In lacerations of the lid, the skin adjacent to the wound should be thoroughly cleansed and the edge debrided. Fine silk sutures should be placed so as to approximate the edges as exactly as possible. It is important that the first suture be placed at the end of the laceration so that there will be no notching at the edge of the lid following healing. The remaining sutures should then be placed to approximate the edges of the wound. If the edges of the wound are not properly sutured in place, ectropion, entropion, and ephiphora will be apt to occur. If the tear ducts are cut, they should be sutured after a probe has been inserted to prevent narrowing of the lumen.

Penetrating wounds of the eye are all serious, and if the history is at all suggestive of a possible intraocular foreign body the eye should be x-rayed as soon as possible. Often it is impossible to find a wound of entrance made by a foreign body. The fact that no foreign body is seen on x-ray examination does not rule out intraocular foreign body as some are nonopaque to x-ray. Intraocular foreign bodies may be magnetic or non-magnetic. The magnetic ones are removed with a magnet which the engineering officer of the ship can make. The nonmagnetic bodies are a problem out here as well as in civilian practice. Some nonmagnetic foreign bodies have been removed from the vitreous humor with special forceps under direct vision (ophthalmoscope), but this is a most difficult operation. In penetrating wounds of the eye the prognosis depends on the size of the foreign body, what structures are involved, the amount of damage done to

them, and how soon it can be removed. Many foreign bodies, especially if of copper, if left in the eye set up a chemical irritation with subsequent loss of the eye. All are familiar, of course, with sympathetic ophthalmia as a possibility in all intraocular foreign bodies. As a rule a few days delay in removing an injured eye does not increase the likelihood of sympathetic ophthalmia. This condition usually comes on from 3 weeks to a year following the injury. A foreign protein should be given all penetrating wounds of the eye and repeated in 48 hours. Atropine solution should be instilled and the eye bandaged. Often, even though the foreign body has been removed, there are complications such as iritis, detachment of the retina, traumatic cataract, dislocation of the lens, large areas of retinal and choroidal damage, and damage to the optic nerve. The treatment of the complications mentioned has no place in a paper of this type.

In cases where the eye has been practically shot away or grossly lacerated with collapse of its contour, the only treatment is enucleation or evisceration. There is no particular hurry about performing one of these operations and often there are concomitant injuries to other parts of the body, especially the skull, which should be taken care of first before the removal of the eye. Such cases should have a firm eye bandage and pain-controlling drugs until the proper time for the eye operation.



JAUNDICE IN GOANS

* * * It appears that jaundice is endemic in Goa, and at times it crops up in an epidemic form. * * *

"THE CURIOUS GOAN METHOD OF TREATMENT.

The forearm is washed with soap and water. A lint piece soaked in salt water is placed on the forearm; it is usually a small piece of lint 2 inches by 2½ inches. A spoon is made red-hot and branding is done over the lint piece. The vesicle which is produced is dressed with another lint piece soaked with the yolk of an egg. The serous fluid which exudates from the wound is encouraged; that completes the operation.

The people have very great faith in this crude method of treatment and I may add that I have seen it done on several occasions and that there appear to be good results from it. I wonder if the branding produces some effect comparable to protein shock or to the use of an auto-vaccine. * * *

The response to the Goan method of treatment is immediate and dramatic. It would need further investigation to consider what curative action a vesicle can have in the treatment of jaundice.

* * *—DE MELLO, J. P.: Jaundice in Goans. *East African M. J.* 23: 87-89, March 1946.

X-RAY DARKROOM TRAINING AS AN ADJUNCT TO THE REHABILITATION OF THE BLIND

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A program for the training of newly blinded patients in x-ray darkroom techniques has been in operation at the United States Naval Hospital, Philadelphia, Pa., for over 18 months. This project has been so successful that it is considered advisable to publish some information concerning the routine in the hope that other institutions will train similarly handicapped patients and that additional positions for employment of individuals so trained will be made available.

The program was instituted in September 1944, when the dental department of the hospital was enduring a temporary shortage of well-trained, enlisted personnel. It was felt that the use of newly blinded patients would not only provide much needed services, but also would be extremely beneficial to the men so trained. Both anticipations have been more than justified. Patients selected for the work were dependable men whose records of previous interests indicated that they might fit into a program of this sort. All newly blinded patients do not make desirable candidates. The work requires intelligence, a keen sense of responsibility and the ability to profit from mistakes. Not all blind individuals have these qualities, and in the selection of personnel it was necessary to remember that the blind are subject to all the faults of the sighted with the additional handicap of lack of vision.

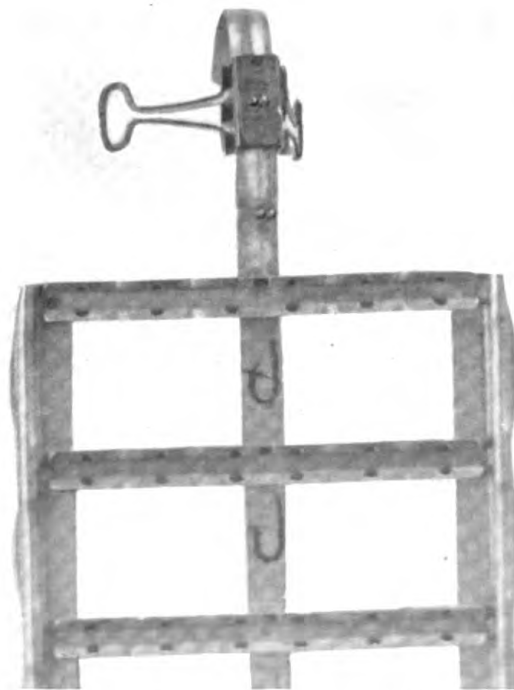
The first patient selected was instructed in darkroom procedure by the writers. He trained his own successor, as has each subsequent patient enlisted in the program. Accordingly, the newly blinded patient is not only encouraged by his ability to accept responsibility, but is provided with the extremely stimulating sensation of passing on his knowledge and being in a supervisory position over others. For many of the blinded technicians the requirements of teaching and supervision of subordinates were completely new experiences. One of the men was so successful in this phase of his training that he

was subsequently employed at a civilian hospital to instruct classes of sighted students in x-ray darkroom procedures.

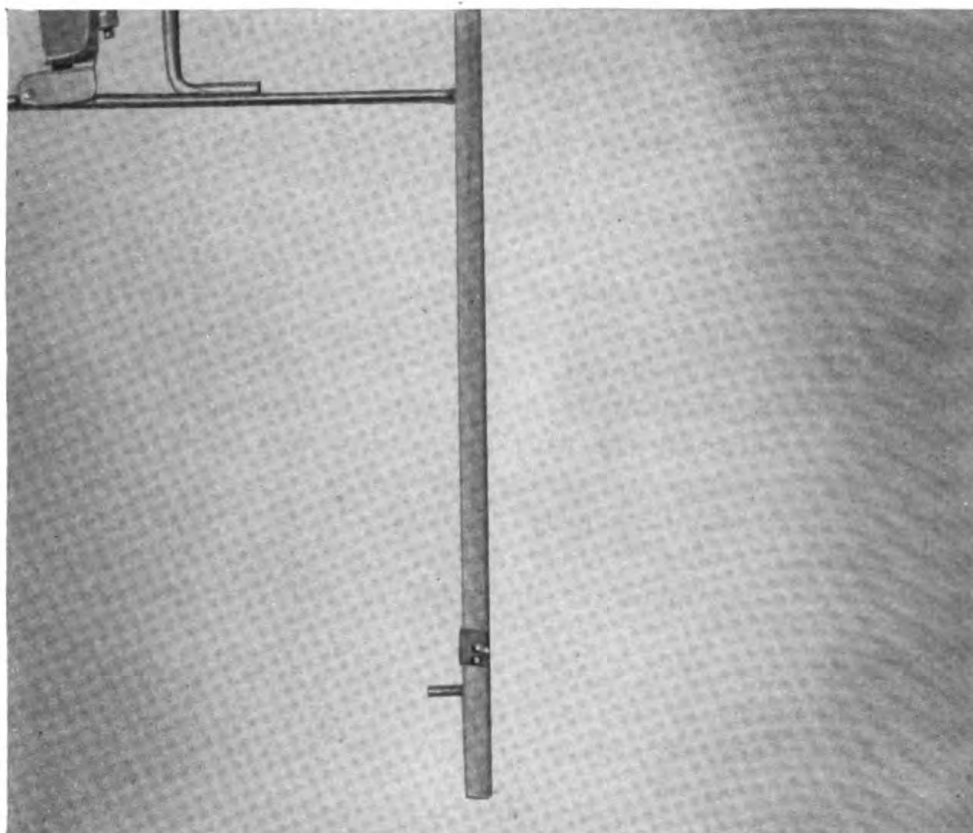
Patients are assigned to the program for a period of at least 6 weeks, of which 2 weeks are spent under instruction, 2 weeks independently, and 2 weeks instructing their successors. Working hours are usually from 1330 to 1530 daily, and the trainees are held responsible for the cleanliness of the darkroom and maintenance of the developing solutions in addition to their processing responsibilities. The trainees are made aware from the beginning that absence and tardiness will not be tolerated, and that the satisfactory performance of their duties is essential to the efficient functioning of the dental department. Naturally the work load varies, but facilities are provided so that 140 intra-oral radiographs and 8 extra-oral radiographs can be managed simultaneously. To date 12 men have completed the program, of whom 2 have received additional training in the general x-ray department in which 300 to 500 films are processed daily.

Blindness is almost an asset in a darkroom, but makes necessary some modifications in normal darkroom equipment. Fortunately, most of the alterations can be made easily, and at little expense. With a little assistance most blind technicians are able to convert the normal darkroom into one which will satisfy their needs.

Intra-oral films are placed in small envelopes bearing the patient's name, by the individual who exposes them. Similar envelopes are prepared for the extra-oral radiographs and are fastened to the edge of the cassette by means of the gummed envelope flap. All the developed frames, intra-oral and extra-oral, are equipped with small copper tabs marked with Braille numerals (figs. 1 and 2). Spring type pressure-



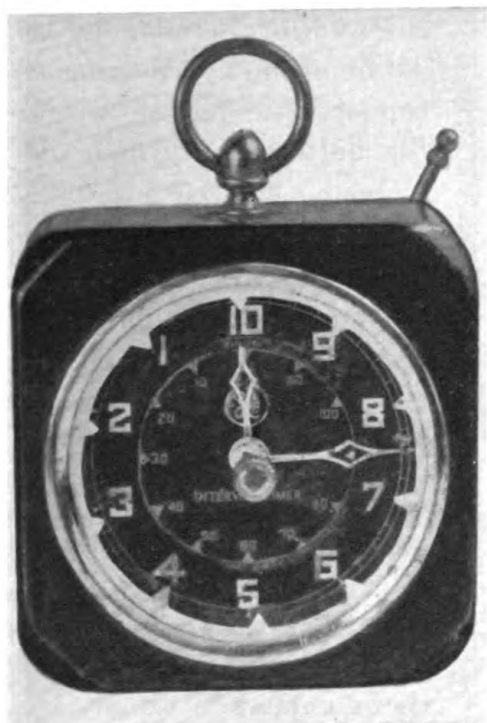
1. Intra-oral developing hanger, showing Braille tab, and spring type paper clip with corresponding Braille marking.



2. Detail of extra-oral developing hanger showing Braille marking.

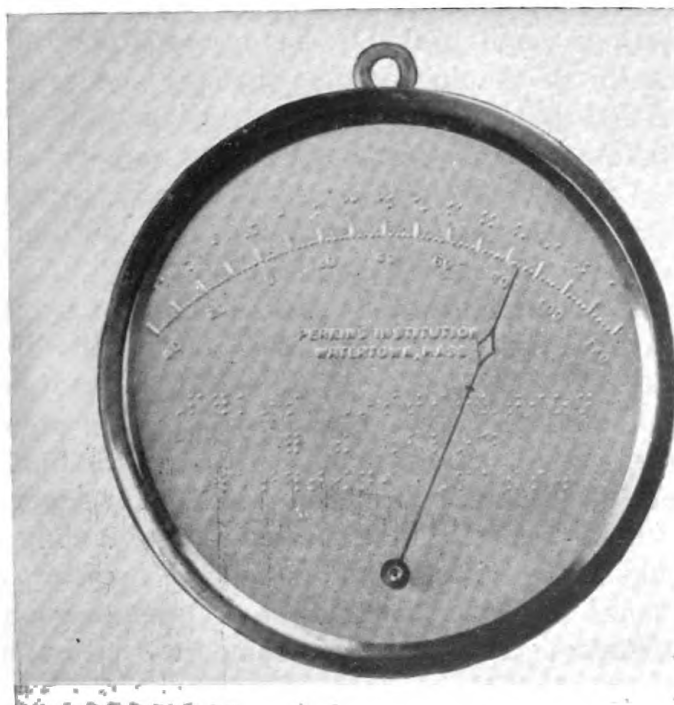
opening paper clips (purchasable in stationery stores) marked with similar copper tabs, bearing matching Braille numerals (fig. 1) are also clipped to the hanger. The blind technician racks up the films and applies the matching paper clips to the envelope from which they were taken. The films are then carried through the developing, fixing, washing, and drying stages. After drying, the technician removes the developed films from the racks and returns them to the proper envelopes, returning the Braille-marked envelope-clips to their positions on the corresponding developing hangers, where they will be ready when the next "run" is started. Extra-oral radiographs are processed in much the same manner, the small envelopes being clipped to the processed films with ordinary bent paper clips.

Since careful maintenance of the proper ratio between developing time and the temperature of the developing solution is essential for successful film processing, it was necessary to work out some means for controlling these conditions. The ordinary darkroom interval timer was easily adapted for use by the blind, by merely removing the glass and inserting in its place a metal circle with projections opposite each numeral (fig. 3). With this revised instrument, the

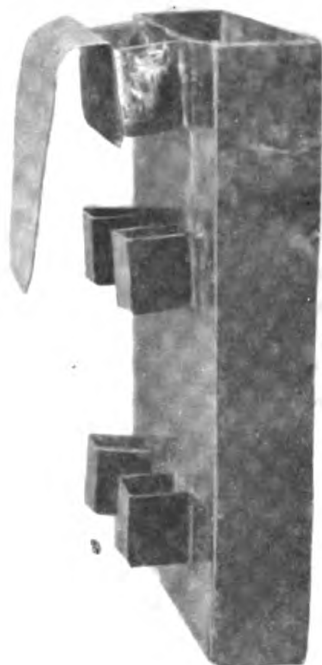


3. Interval timer showing projections opposite each numeral.

technician could easily set the timer for the desired developing time by counting the desired number of projections away from zero and setting the hands accordingly. Temperature indication was a far more difficult problem, and has not yet been really satisfactorily solved. Braille thermometers are made by the Perkins Institute for the Blind of Watertown, Mass., but they are of the aneroid type, and cannot be placed in the developing solution (fig. 4). Satisfactory use of



4. Braille thermometer.



5. Copper container for Braille thermometer.

this type of thermometer has been accomplished by making use of a copper case (fig. 5), weighted at the bottom, into which the thermometer can be inserted. This case is placed in the solution and is attached to the side of the tank. Inasmuch as copper is an extremely good conductor of heat, the temperature inside the container is approximately the same as the temperature of the solution. If the thermometer is allowed to remain in the case it will indicate within 1° or 2° the temperature of the solution. The unsatisfactory features of this arrangement are that the thermometers may get wet and as a result become inaccurate, together with the fact that a slight inaccuracy is induced by the lack of close contact between the thermometer and the solution.

Both these objections could probably be overcome by building a thermometer into the developing bath so that its back is in contact with the solution and its face completely outside the tank, free from exposure to moisture. Most blind technicians rapidly develop a very keen sense of temperature sensation and usually, by the end of their training period, can estimate very accurately the temperature of the solution and the required developing time.

The developing and fixing solutions can be prepared by the blind technician, but some assistance in the preparation of the first batch is desirable. Braille copies of the directions on the containers are furnished to each student before he undertakes the preparation. These instructions should remain available to him so that he can refer to them when he prepares subsequent mixes of developer or fixer.

These fundamentals will usually be mastered quite rapidly, but the neophyte will make many mistakes and patience is necessary. Blind technicians will make all the errors of sighted apprentices and a few more in addition, but since darkness has become their natural medium, they will usually not repeat their errors. The most common mistakes are the processing of films without turning out the lights, and allowing detached films to stop up the overflow pipe so that the running water

will overflow the edges of the tank. Both these mishaps can usually be avoided by teaching the technician to palpate the light bulb and overflow pipe in advance.

There is little more to be said about either the technique of teaching or the modification of equipment. Most of the newly blinded seem to learn more rapidly than sighted personnel, and often become such adepts that they can shave, shine their shoes or read while processing films and carry out both endeavors satisfactorily.

To date 12 men have been trained to the extent that they are able to manage satisfactorily positions as darkroom technicians. While this number seems small, consideration must be given to the fact that the program was carried on as a special feature in conjunction with rehabilitation classes, plastic surgery procedures, and other activities of the over-all program for the blinded. It must also be remembered that there have been less than 200 totally blinded in the Navy, Marine Corps, and Coast Guard during the recent war. At negligible cost to the Navy Department, this darkroom training has furnished an almost complete means of rehabilitation for more than 5 percent of the totally blinded. Of the patients so trained, 3 are still hospitalized, 4 are known to be working as darkroom technicians in civilian hospitals at salaries of \$100 or more monthly, and 3 others have been offered similar positions and have either rejected them or have accepted them temporarily while preparing themselves for other fields. Some of the most competent of the men who have completed the course have been unable to find employment because the nature of their skills was unknown in their home localities. To this end the authors are most anxious to act as liaisons between hospitals interested in blind technicians and the men thus far trained in this capacity.

The possibilities for development in this field seem extensive. The training need not be limited to x-ray work, but could be expanded to include commercial photography where the time-temperature technique of developing is used. Nor need the work be limited to the veterans; it offers a new field to many blind civilians. The United States Employment Service in New York has recognized the possibilities and has requested advice in the placement of some of the employable technicians. It is the hope of the authors, indeed their principal object in preparing this article, that further stimulation will be given this program, that similar training will be carried on in other institutions and that this expanded program will increase the placement possibilities.

THE MECHANISM OF ANTIVIRAL IMMUNITY

Authors' discussion.—The results obtained with herpes virus and infectious ectromelia virus are identical. The virus is not inactivated by leukocytes of normal or immune animals. It will be noted that these experiments were carried out with a minimal amount of infective material. The initial material (virus dilution 1:400) contained 2.5 infectious doses, but in the thermostat and at room temperature, its infective capacity decreased, and the leukocytes had actually to inactivate not more than one certain infective dose. The fact that no inactivation occurred at all conclusively indicates that the leukocytes do not play any part in herpes immunity. The herpes virus was not tested with leukocytes of naturally immune animals, such as frogs, since sufficient leukocytes could not be procured from them owing to technical difficulties. However, it can hardly be assumed that leukocytes play any role in natural immunity to herpes virus, for otherwise our results would have been different with leukocytes of immune animals in the presence of immune serum.

Authors' summary.—1. Leukocytes of various types (polynuclear and mononuclear) do not inactivate or fix the virus of infectious ectromelia

2. This holds for the leukocytes of animals whether susceptible (mice) or nonsusceptible (rabbits, guinea pigs) to the ectromelia virus, as well as for those of artificially immunized animals (mice).

3. Sera of normal rabbits, guinea pigs, and mice, as well as sera of immune mice do not facilitate inactivation of the infectious ectromelia virus by the leukocytes.

4. Inactivation of the ectromelia virus by leukocytes does not take place either in vitro or in vivo.

5. Leukocytes of various types taken from susceptible and artificially immunized animals do not inactivate herpes virus when suspended in saline or in normal or immune serum, nor does inactivation occur in vivo.

6. In some cases leukocytes taken from immune animals may fix herpes virus although they do not neutralize it.

7. It is suggested that leukocytes do not play any role in the mechanism of natural and acquired immunity to infectious ectromelia and herpes.—SILBER, L. A. and SHUBLADZE, A. K.: The mechanism of antiviral immunity. *Am. Rev. Soviet Med.* 3: 217–228, February 1946.

A MOBILE SURGICAL UNIT IN A COMBAT AREA

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In a previous article ¹ one of us described the design and construction of a new mobile surgical unit. The present paper deals with its use during the campaign on Okinawa and attempts to show the advantages of this type of unit. It also points out various errors and how they may be corrected for future operations.

During the 4-week period the trailer was used in a rear area prior to the invasion, only 7 operations were performed, but this trial indicated that the unit would be of definite value in treating battle casualties.

Preparation for the amphibious operation included fitting the unit with surgical instruments and supplies to perform 6 major operations without resterilizing instruments and 12 major cases without resterilizing linens. Electric and field autoclaves, electric instrument sterilizer, electric suction machine, oxygen tank with Boothby mask, transfusion and intravenous sets, plasma, saline, and pharmaceuticals were carried. Just prior to boarding ship every remaining cubic foot of space was utilized for a combat load of cots, mattresses, blankets, litters, splints, entrenching tools, and empty sand bags. Marsten matting, tarpaulin, camouflage net, and tent poles were lashed topside.

No difficulty was encountered in loading the trailer aboard ship in spite of the fact that a double transfer was effected, from shore to an LCT and thence aboard an APA by hoisting. Deliberate deck load-

¹ MERSHEIMER, W. L.: Mobile surgical units for amphibious warfare. U. S. Nav. M. Bull. 45: 551-556, September 1945.

ing of the trailer permitted ready access to it during the prolonged time at sea, facilitated resterilizing equipment and supplies a few days before "hitting the beach," and permitted it to be among the first vehicles debarked.

For the initial landing, the surgical team consisted of a general surgeon, an orthopedic surgeon, an anesthetist, and a fourth member to assist at surgery and in preoperative and postoperative care of patients. Ten hospital corpsmen, three of whom were trained operating-room technicians, four Marine Corps guards, and a driver completed the personnel of the unit. Debarkation was accomplished on L+2 without untoward incident. The vehicles (mobile surgical unit, 2½-ton, 6 x 6—prime mover—and ¼-ton, 4 x 4, ambulance jeep) were transported to the beach aboard LCMs and hauled ashore by tractor. The initial emplacement of the trailer was in the courtyard of a burial vault which afforded all the protection of a tediously prepared position. By spreading the Marsten matting topside, a relatively fragment-proof shelter was effected. The position was completed by covering with the camouflage net (fig. 1). A shelter for the preoperative and postoperative care of patients was set up next to the trailer in a bull-dozed area over which was erected a tarpaulin. The unit was immediately adjacent to the Beach Evacuation Station. Within an hour of arriving at the location the first casualty was undergoing major surgery. Postoperative patients were kept only until such time as they could be evacuated safely to LSTs.

The rapidity of the Third Amphibious Corps' advance and the light casualties sustained precluded a long stay on the beach. Consequently, on L+4 the unit moved inland to Sobe and remained there until L+7. The trailer, two pyramidal tents for wards, tarpaulins for "pack room" and quarters were all set up in the open. Inadequate protection proved extremely costly during the heavy air raid of 6 April when one of us was wounded, sustaining a compound fracture of the humerus. He was the unit's only casualty. When service personnel were not being treated we assisted an adjacent Military Government dispensary for civilians which was without facilities for major surgery. Again service patients were retained only until they could make the shore to ship movement safely.

At this time the Third Amphibious Corps Medical Battalion was preparing to establish a field hospital at Tokeshi. Accordingly, on L+7 (8 April), the mobile surgical unit joined the Medical Battalion and ceased to function independently. The trailer served as one of three operating rooms of the hospital. During this period over 70 percent of all operations was performed in the mobile surgery which offered excellent fragment protection and furnished black-out which was essential to night surgery. The method of protecting the unit



Figure 1.

deserves special mention. A trench was bulldozed so that the trailer was sunk until the deck was level with the ground. A double tier of 55-gallon drums filled with dirt and topped by several layers of sandbags protected the bulkheads. The entrance was buttressed in a similar fashion. The Marsten matting and a layer of sandbags were placed topside (fig. 2).

No further move was made until the northern half of the island was secured and the Marines of the Third Amphibious Corps took the offensive to the south. This move was to Chatan on L+39 (10 May) and was the final and permanent camp site of the Medical Battalion.



Figure 2.



Figure 3.

During this phase the mobile unit functioned as one of four operating rooms and about 25 percent of the total number of operations was performed in it. For protection a deep pit was excavated by steam shovel and the trailer buried to the overhead, precluding the necessity of drums to protect the bulkheads. The overhead was shielded in the usual manner (fig. 3). Later, a room which functioned as an additional storage space and "pack room" was built adjoining the trailer (figs. 4 and 5).



Figure 4.

With the breaking of the Yonabaru-Shuri-Naha line the Marines pushed rapidly south. Transportation of wounded to the established hospitals in the rear became increasingly difficult. On L+73 (13 June) the Third Amphibious Corps Surgeon ordered the mobile surgical unit south to Itoman where it was set up in support of C Medical Company, First Marine Division, the most forward field hospital. At this time ambulance-plane transportation was made available from Itoman to Chatan in the vicinity of the established hospitals. Marine casualties were brought through C Medical Company and whenever possible evacuated by plane to the rear. However, when the serious nature of the patient's injury precluded flight and when plane transportation was not available (dusk to dawn), he was retained for definitive surgery. The surgical team, consisting of three medical officers and three hospital corpsmen, remained with

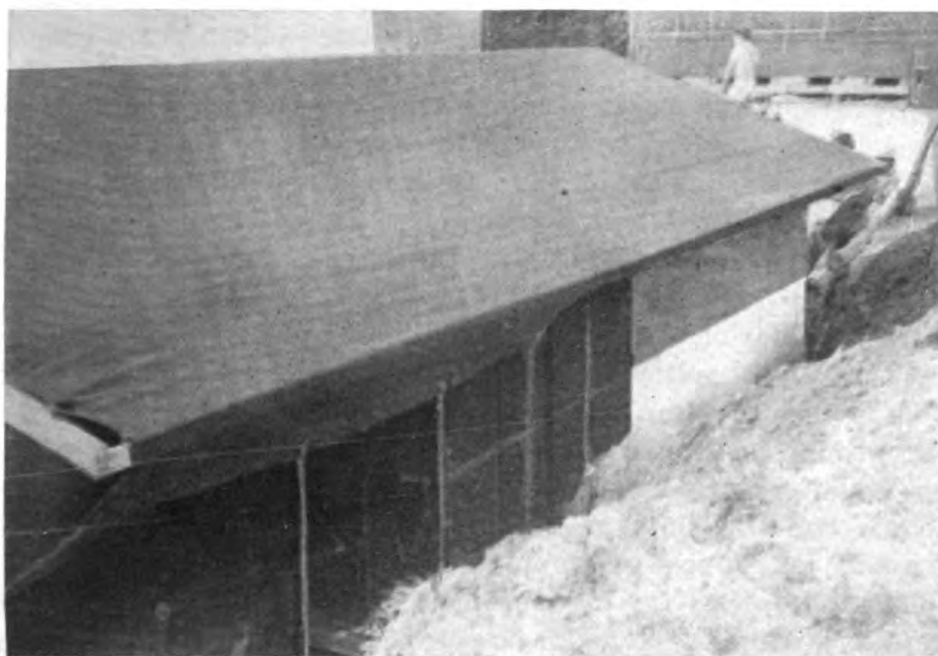


Figure 5.

C Medical Company until the island was secured, returning to our field hospital on L+84 (24 June).

The final phase, which included the sixth and seventh moves, was with civilian hospitals of the Military Government, first at Chimu, 27 to 30 June, and second at Koza from 30 June to 5 July. During this time very little acute surgery was done; nearly all casualties treated were old neglected compound fractures.

Table 1 shows the number and distribution of injuries. It is not the purpose of this article to enter into a lengthy analysis of war injuries or the methods of treatment. However, a few explanatory

remarks are applicable. There were 239 patients operated upon for a total of 423 injuries (multiple wounds of one organ or multiple soft tissue wounds were considered as one injury). The 23 nonbattle casualties are listed in table 2. There were 20 deaths which are tabulated in table 3. Since adequate follow-up is not available on all patients, this table may be incomplete. However, the majority of the seriously wounded patients were followed for 8 to 15 days and were not evacuated until it was felt that their successful recovery was assured.

An attempt will be made to point out some of the difficulties encountered and how they may be corrected. First, replenishment of water supply was extremely difficult during the first days ashore and was completely remedied only when a water trailer was allotted. Second, the single 1,500-watt generator was not capable of delivering sufficient electricity over a long enough period. This was solved by alternating two 1,500-watt generators, but even this did not prove as satisfactory as a generator of the 6.3 or 7.5 KVA type. Third, unless definite arrangement can be made for exchange of soiled linens a washing machine is essential. When on the beach and at Sobe, exchange of linens was effected with a ship. At Itoman, Chimu, and Koza they were returned to the battalion laundry. At all times packing and sterilizing was done by the unit hospital corpsmen. Fourth, much time was lost preparing food for the patients and attached personnel. Therefore a Marine Corps cook should be assigned. Fifth, the trailer should be packed only with gear necessary for its maintenance. This should include the time of initial ship-to-shore movement. Sixth, the addition of an adjustable operating-room table (for one field operating-room table), a portable fracture frame, and a closed-system anesthesia machine would facilitate the treatment of battle casualties.

An adequate supply of refrigerated universal-donor blood must be available. At least 32 pints packed in an insulated box and refrigerated with dry ice should be carried for the initial landing, and arrangement should be made for replenishing the supply.

The detailed fitting and equipping will naturally vary with the wishes of the surgeons assigned to the unit, the ease of replenishing supplies, the locality of the action, and whether it is to function in support of existing medical facilities or as a completely independent unit. It is felt that the minimum personnel required in the latter instance is four medical officers (a general surgeon, an orthopedic surgeon, an anesthetist, and an assistant) four trained operating-room technicians, four ward hospital corpsmen, two hospital corpsmen to pack and sterilize supplies (an additional one if soiled linen is to be laundered), one cook, one driver, and four guards.

What is the role of a mobile surgical unit and how may it best be

used? It is evident that the greatest advantage of the trailer is its high mobility. A completely equipped and self-sustaining operating room is rolled into position. It is necessary then only to open it, receive casualties, and begin the necessary surgery. With a large field hospital, such as that of the Third Amphibious Corps Medical Battalion, the mobile surgery loses much of its value after the portable plywood operating rooms are erected and equipped. For this reason the trailer should then be made available to a higher echelon to order it to that sector which is receiving the heaviest casualties, where it may supplement existing medical facilities, or initiate an independent activity. It is the opinion of the Corps Surgeon and the commanding officer of the Medical Battalion that the former is more efficient. Mobile surgeries will prove of great value with the Medical Companies attached to Marine Corps regiments inasmuch as these companies must move frequently. In addition, a reserve or pool of mobile units should be established by Corps so that they may be despatched to supplement units which are receiving heavier casualties than can be treated adequately. Also this will prevent periods of enforced idleness. It is a well-known fact that the earlier a patient receives definitive treatment the greater are his chances of successful recovery, and his chances will be still greater if he does not have to travel long distances over inadequate roads. This will be accomplished only by the use of highly mobile operating rooms which are capable of keeping up with the fighting front.

TABLE 1.—*Battle casualties*

Avulsed wounds requiring amputation:		Fractures (93 patients)—Continued	
Arm.....	1	Compound—Continued	
Forearm.....	2	Metacarpal (one or more).....	3
Thigh.....	1	Phalanx (one or more).....	8
Leg.....	1	Pelvis.....	13
Phalanx.....	8	Femur.....	18
Total.....	13	Patella.....	1
		Tibia.....	15
Fractures (93 patients ¹):		Fibula.....	6
Compound		Tarsal.....	1
Skull.....	3	Metatarsal (one or more).....	2
Mandible.....	1	Total.....	114
Vertebra.....	3	Simple	
Clavicle.....	2	Skull.....	1
Scapula.....	4	Femur.....	1
Rib (one or more).....	12	Total.....	2
Sternum.....	2	Total all fractures.....	116
Humerus.....	9		
Radius.....	7		
Ulna.....	4		

For footnote, see next page.

TABLE 1.—*Battle casualties*—Continued

Joint:		Intra-abdominal (52 patients)—	
Hip.....	1	Continued	
Knee.....	5	Large intestine.....	23
		Liver.....	12
Total.....	6	Gall bladder.....	2
		Pancreas.....	1
Tendon.....	3	Spleen.....	6
Nerve.....	3	Kidney.....	6
		Bladder.....	6
Intra-thoracic (51 patients ¹):		Major intra-abdominal blood	
Traumatopneic.....	26	vessel.....	12
Non-traumatopneic, perforat-		Blast concussion.....	1
ing.....	24		
Empyema (civilians).....	2	Total.....	89
Blast concussion.....	1		
Heart.....	1	External genitalia:	
Diaphragm.....	12	Penis and urethra.....	5
		Scrotum and testicle.....	6
Total.....	66	Total.....	11
Intra-abdominal (52 patients ^{1 2}):		Ophthalmic.....	3
Stomach.....	5	Burns.....	5
Small intestine.....	15	Soft tissue.....	108
¹ Patients with combined major wounds:			
Intra-thoracic and fracture.....	10		
Intra-abdominal and fracture.....	12		
Thoraco-abdominal.....	9		
Thoraco-abdominal and fracture.....	8		
² No intra-abdominal pathology in 4 laparotomies.			

TABLE 2.—*Nonbattle casualties*

Appendicitis.....	13	Benign tumor of the tibia.....	1
Obstructive jaundice.....	1	Abscess.....	5
Inguinal hernia.....	1		
Hemorrhoids.....	1	Total.....	23
Varicose veins.....	1		

TABLE 3.—*Tabulation of mortality*

Diagnosis	Procedure
1. Compound fracture femur with extensive infection (civilian).	Debridement.
2. Compound depressed skull fracture; partial avulsion of frontal lobe.	Debridement and subtotal excision of frontal lobe.
3. Perforation of duodenum and stomach, lacerated kidney, and extensive retroperitoneal hemorrhage.	Subtotal gastric resection and gastroenterostomy; left nephrectomy.
4. Multiple perforations of ileum and sigmoid; ruptured bladder; laceration of penis and urethra.	Exteriorization of sigmoid, double-barrel ileostomy; repair of bladder, suprapubic cystostomy; repair of penis and urethra.

TABLE 3.—*Tabulation of Mortality*—Continued

Diagnosis	Procedure
5. Multiple perforating wounds of sigmoid and rectum; ruptured bladder; lacerated internal iliac vein.	Ligation of internal iliac vein; closure of perforations; sigmoidostomy; repair of bladder, suprapubic cystostomy.
6. Compound fractures of femur and metacarpal.	Debridement, removal of foreign body, hip spica.
7. Extensive laceration of sigmoid; compound fractures of femur, tibia, and fibula; multiple soft tissue wounds.	Obstructive-type resection of sigmoid, debridement of compound fractures and soft tissue wounds. Application of traction splint.
8. Blast concussion; avulsion of buttocks; compound fractures of ilium, sacrum, and femur.	Debridement of soft tissue wounds. Hemostasis.
9. Penetrating wound of left lung, and diaphragm; ruptured left kidney; compound fractures of left tenth and eleventh ribs and tenth and eleventh vertebrae with spinal cord lesion.	Debridement and primary closure of thoracic wound; laparotomy; left nephrectomy.
10. Obstructive jaundice.	Cholecystostomy.
11. Ruptured bladder; compound fracture of sacrum; multiple wounds of buttocks and thighs.	Repair of bladder; suprapubic cystostomy; debridement and packing of soft tissue wounds.
12. Penetrating wound of left ventricle, diaphragm, liver, and pylorus, with massive intra- and retro-peritoneal hemorrhage.	No operation. Death occurred during induction with ether anesthesia.
13. Multiple perforations of small intestine, sigmoid and transverse colon, liver and gall bladder; compound fracture of ilium; avulsed wound of right arm.	Resection and end-to-end anastomosis of small intestine; closure of perforations of colon; resection of gallbladder; debridement and packing of avulsed wound of arm.
14. Perforation of left lung and diaphragm; ruptured spleen; multiple perforations of stomach and colon; compound fractures of left tenth rib, right tibia and fibula.	Debridement and primary closure of sucking wound of the chest; splenectomy; closure of perforations of stomach and colon. Debridement, packing, and application of traction splint for compound fracture of tibia and fibula.
15. Multiple perforations of the small intestine; laceration of the mesentery with massive intraperitoneal hemorrhage; multiple wounds of forearm and thigh.	Resection and end-to-end anastomosis of small intestine. Hemostasis of mesenteric hemorrhage. Debridement and packing of multiple soft tissue wounds.
16. Multiple lacerations of ascending colon with extensive intra- and retroperitoneal hemorrhage; compound fracture of ilium.	Subtotal colectomy and ileocolostomy.
17. Extensive lacerations of liver.	Suturing and packing of lacerations of liver.
18. Complete transverse laceration of colon with evisceration; ruptured left kidney; compound fractures of left lower ribs and left radius.	Obstructive-type colostomy; left nephrectomy; debridement, packing, and splinting of radius.
19. Multiple perforations of ileum, cecum and sigmoid; massive intraperitoneal hemorrhage; compound fracture of sacrum.	Resection of ileum and end-to-end anastomosis; closure of cecal perforations; obstructive-type sigmoidostomy. Packing for continued and uncontrolled hemorrhage.
20. Compound fracture of femur with extensive osteomyelitis (civilian).	Debridement and packing, application of traction splint.

ISOLATION AND IDENTIFICATION OF ENTERIC PATHOGENS AT A NAVAL BASE IN NORTH AFRICA

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This report intends to demonstrate an efficient and rapid method for the isolation and identification of enteric pathogenic organisms. The methods of obtaining specimens and culturing are the results of 15 months' experience gained at a large naval operating base in North Africa.

When this unit was first assigned to this area, it was found that there had been some serious epidemics of dysentery among naval personnel stationed here. It was also learned by discussions with civilian public-health officials that diarrheal diseases among civilians were very prevalent in a city with a population of 250,000 people. Our early examination of the city's water supply indicated that there was ample opportunity for water-borne enteric diseases. Naval personnel had every opportunity to be exposed to diarrheal diseases outside of their respective activities. It was decided, therefore, to carry out routine enteric-pathogen surveys among all naval food handlers and on all individuals hospitalized at the naval dispensary with gastro-enteritis.

A total of 70 enteric pathogens was isolated, including 14 different species of shigellas. Tables 1 and 2 give the results of the stool cultures performed on patients who were admitted to the naval dispensary with the diagnosis of gastro-enteritis.

From table 2 it can be seen that *Pseudomonas aeruginosa* accounted

TABLE 1.—Cases of gastro-enteritis hospitalized at the naval dispensary

Number of cases	Number positive for enteric pathogens	Percent positive
71.....	33	46.5

¹ Members of Epidemiology Unit No. 23 assigned to this naval operating base.

TABLE 2.—*Types of enteric pathogens isolated from gastro-enteritis cases at the naval dispensary*

Genus	Species	Number	Percent of total
Shigella	sonnei	2	6+
Do	dysenteriae	1	3+
Do	ambigua	1	3+
Do	alkalescens	1	3+
Do	ceylonensis	2	6+
Do	Sachs Q1030	4	12+
Do	Sachs B105 ¹	1	3+
Do	flexneri I-III	2	6+
Do	flexneri II	1	3+
Do	flexneri VI	1	3+
Do	flexneri X	1	3+
Do	flexneri XIV	1	3+
Do	unidentified	2	6+
Pseudomonas	aeruginosa	12	36+
Proteus	mirabilis	1	3+
Total		33	

¹ Sachs B105 is motile and is considered by some not to be a shigella.

for 36 plus percent of the enteric pathogens isolated from cases of gastroenteritis. The fact that, in most instances, it was isolated in almost pure culture, suggests that it plays an important etiologic role, and that more attention should be attached to this organism as a cause of gastroenteritis.

In order to eliminate the need for food handlers submitting stools, which was both inefficient and difficult, especially so where the activities are located at some distances, up to 25 miles, from the laboratory, specimens were collected by the rectal swab method. It was found that, by using a small applicator stick tightly wrapped with cotton dipped in glycerin and by having the individual bend over and pull the buttocks apart, it was possible to pass through the sphincter and into the rectum without any difficulty.

On routine surveys among food handlers for enteric pathogens, two different types of media of graded inhibitory effect were used, one which would inhibit the growth of most strains of colon bacilli, and another which would grow the colon bacilli. This allowed for a greater number of positive isolations. On surveys performed at this base sodium desoxycholate-citrate agar and sodium desoxycholate agar were employed. These had the advantage of speed in preparation, as it is not necessary to autoclave the media, and good growth and isolation of the enteric pathogens were obtained.

The material on the swab was rubbed on one side of each of the plates, using one-half a plate for each individual. By having one man take the name of the food handler, a second obtain the rectal culture, and a third smear the swab on the plate, at least 50 cultures can be obtained in one-half an hour. The plates then were taken immediately to the laboratory and the inoculum streaked out with a platinum loop.

The next day all colorless or brownish colonies on the differential agar were transferred to Russell's double sugar. If there was the slightest doubt about a colony, it was still inoculated into the double sugar, for oftentimes they turned out to be pathogens.

On the third day the Russell's double sugar was examined, especially for those giving an acid (no gas) and alkaline slant reaction. It has been found that the majority of these turned out to be shigellas; a few, paracolons antigenically related to *Shigella ceylonensis*. The activities at which the men from whom were obtained the cultures giving the above reactions in Russell's double sugar were serving were advised to remove those men from handling food for a period of 3 days until more definite results were obtained.

Media used for the biochemical reactions.—Ten-percent solutions of dextrose, lactose, mannitol, and sucrose in distilled water were made in 2-ounce bottles and autoclaved at 12 pounds pressure for 10 minutes. By means of a pipette, 0.5 cc. of the individual sugar solutions was added aseptically to 5 cc. tubes of previously sterilized phenol-red broth base, each containing a fermentation tube; nutrient agar slants, pH 7.3, were used for carrying stock cultures; 1-percent proteose-peptone water was used for the motility, H₂S, and indol tests. Lead-acetate paper and oxalic-acid paper were used to test for the H₂S and indol reactions.

The growth on the slant of Russell's double sugar was then transferred to a nutrient-agar slant, dextrose, lactose, mannitol, and sucrose phenol-red broth bases, and proteose-peptone water. Strips of oxalic-acid paper and lead-acetate paper were suspended over the proteose-peptone water.

By using these four sugars and testing for motility and indol, a very good idea of the organism isolated could be obtained. Table 3 gives the biochemical reactions by means of which the shigellas were presumptively identified.

TABLE 3.—Biochemical reactions for the presumptive identification of shigellas

Dextrose	Lactose	Mannitol	Sucrose	Indol	Motility	Tentative shigella identification
A	—	A	±	—	—	flexneri.
A	(A)	A	±	+	—	ceylonensis or madampensis.
A	—	—	—	+	—	ambigua.
A	(A)	A	—	—	—	sonnei.
A	—	—	—	—	—	dysenteriae or Sachs' group.

At the end of 3 days, if the organism satisfied all the biochemical reactions of a shigella, the food handler from whom the organism was isolated was removed from handling food for 2 weeks and put under treatment. At the end of this period, a repeat culture was taken, and, if negative, the messman was allowed to go back on duty.

A thorough search was made for *Salmonella* by inoculating all organisms giving an acid-gas butt and alkaline-slant reaction in Russell's double sugar into lactose and sucrose phenol-red broth bases, and proteose-peptone water, and tests were made for indol and H_2S . No organisms were found among the food handlers which satisfied the preliminary biochemical reactions of *Salmonellas*, and although a great many cultures did not ferment lactose and sucrose after 14 days, they formed indol.

Cultures, forming gas in dextrose, but not fermenting lactose, isolated from individuals with gastro-enteritis, were sent to the enteric-pathogen laboratory at the National Naval Medical Center, Bethesda, Md., for serological identification. Only one of these turned out to be a pathogen, Sachs B105, the rest being intermediate coliforms.

Organisms of the pseudomonas group could be readily identified by their pigment production on the Russell's slant. Further identification was made by transferring to a nutrient-agar slant where pigment production was more easily seen.

No attempt has been made to identify the organisms serologically in this laboratory. Experience has shown that it only led to confusion. Serums for the rarer types of shigellas are difficult to obtain for field units. The cultures were sent to the enteric pathogen laboratory at the National Naval Medical Center on nutrient-agar slants, stoppered with corks which had been boiled in wax. Table 4 gives the types of enteric pathogens isolated from food handlers.

TABLE 4.—Enteric pathogenic bacteria isolated from food handlers with no gastro-enteritic symptoms

Genus	Species	Number	Percent of total
<i>Shigella</i>	<i>flexneri</i> III	1	2.7
Do	<i>flexneri</i> VI	3	8.1
Do	<i>flexneri</i> X	1	2.7
Do	<i>ceylonensis</i>	13	35.0
Do	<i>madampensis</i>	1	2.7
Do	<i>alkalescens</i>	2	5.4
Do	Sachs Q1030	1	2.7
Do	Sachs B105	1	2.7
Do	Unidentified	1	2.7
Do	Being studied	4	10.8
<i>Pseudomonas</i>	<i>aeruginosa</i>	4	10.8
<i>Paracolon</i>	Related antigenically to <i>S. ceylonensis</i>	5	13.5

It is interesting to note that the carrier rate of *Shigella ceylonensis* among food handlers is very high. This organism has also been isolated from cases of acute gastro-enteritis at the naval dispensary, indicating that there might be an etiologic relationship. *Shigella ceylonensis* might readily be overlooked during carrier surveys due to the fact that it ferments lactose in from 1 to 10 days and, sometimes, not at all.

TABLE 5.—Percentage of enteric-pathogen carriers among food handlers

Number of cultures	Number positive for enteric pathogens	Percent positive for enteric pathogens	Number positive for shigella species	Percent positive for shigella species
1,081	37	3.4	28	2.6

If there was any question of gastro-enteritis in an activity where food handlers were found harboring paracolons related antigenically to *Shigella ceylonensis* and *Pseudomonas aeruginosa*, treatment was advised until it was shown by repeat cultures that these organisms were completely eliminated from the intestinal tract of the carriers.

The routine examination of food handlers for carriers of enteric-pathogenic bacilli here apparently has been effective, in view of the fact that in this area with a large constant personnel in widespread camps there have been but 2 minor epidemics of food poisoning. One was demonstrated to have been caused by staphylococcus enterotoxin. The other was definitely proven to have been caused by carriers of shigella organisms among food handlers.

At a camp with a strength of approximately 1,200, 124 men had gastro-enteritis in a 30-day period. Of these men 23 were hospitalized, and *Shigella flexneri* VI was isolated from 9 stools by the laboratory at Navy Base Hospital No. 9. On a carrier survey among the food handlers at the camp, 10 percent were found to be carriers of enteric pathogens, 3 of *Shigella flexneri* IV, 5 of *Shigella ceylonensis*, 1 of *Shigella flexneri* III, and 1 of *Shigella madampensis*. The high percentage of carriers among the food handlers, the correlation between the organisms found among the patients by a separate activity, and the carriers detected by this unit, all pointed to the epidemic being caused by transmission of the shigella organisms by the food handlers to the food.

SUMMARY

1. A rapid and efficient method for detecting carriers of enteric pathogens among food handlers by biochemical reactions is described.

2. Our criterion for pathogenecity is corroborated by findings at the enteric pathogen laboratory at the National Naval Medical Center, Bethesda, Md.

3. The routine food-handler survey has been worth while in view of the small number of cases of bacillary dysentery among naval personnel in an area where the disease is endemic.

THE VALUE OF THE SOCIAL SERVICE HISTORY IN THE DETECTION OF THOSE PSYCHIATRICALY UNSUITED FOR MILITARY SERVICE

A Study of 500 Enlisted Men

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During the present war much attention has been devoted to the development of methods for facilitating the early elimination of the potential neuropsychiatric casualty from the military service. Although the need for a careful psychiatric interview at time of induction is recognized, such interviews are in reality very brief and often quite inadequate. Thus it has been suggested (Billings, E. G., Ebaugh, F. G., et al., War Med. 4: 283-298, September 1943) that social-service histories for each inductee be made available to the examining physician as confidential information, with the hope that such material would be helpful in detecting the psychiatrically unfit. In a previous study (U. S. Nav. M. Bull. 43: 909-921, November 1944) it was thought advisable to have such histories include the following data: (1) Character of the man's family relationship; (2) history of mental illness in the family; (3) persistence of infantile traits, such as enuresis, marked fears, temper tantrums, nightmares, etc.; (4) history of previous mental illness afflicting the man himself; (5) educational history, adaptability, truancy, scholastic record, etc.; (6) social adjustment in the community, participation in group activities, any peculiarities of personality, etc.; (7) criminal record; (8) employment record; (9) use of alcohol and other drugs; and (10) degree of emancipation from the home. As yet, however, there is little information concerning the effectiveness of such histories in actually identifying those who may develop mental illness under the strain of service life.

The purpose of this study is to test the usefulness of social-service histories as a supplement to the neuropsychiatric examination of inductees for military service. Five hundred enlisted men (U. S. N., U. S. M. C., U. S. C. G., regular and reserve) were chosen at random from among the patients admitted to St. Elizabeths Hospital, Washington, D. C., from January 1942 to May 1944. It was assumed that each man presented a normal enough appearance at the induction

center to be accepted for military service, and that any rejections from this group would have been made entirely on the basis of findings revealed in the social-service histories. In reviewing these cases we attempted to base our decision for acceptance or rejection on the data in such histories. Certain defects of this method of study are apparent. The social-service history taken after a man has been hospitalized (as in these cases) may be more complete than such a history prepared for use at the induction center, many facts being more willingly revealed after the illness is manifest than before. In some cases the history may not in itself afford enough information to warrant rejection, but may be suggestive and justify a request for further material. In the cases reviewed here we have attempted to keep in mind the practical considerations faced by the hurried physician in the induction line, the urgent need for men in the armed services, the brief time allotted for examination, the pressure exerted by the community that often resents the rejection of the man who may seem fit for duty to the eye of the layman, and the still persistent attitude in some places that the ne'er-do-well, the chronic behavior problem should be sent into the military camp as a corrective or disciplinary measure. Hence, we have not rejected cases lightly and have passed some with considerable reluctance, doubting their ability to make a satisfactory military adjustment, but realizing that in actual practice some doubtful candidates would still justify a trial of duty.

TABLE 1.—*Diagnoses of 500 unselected enlisted men hospitalized at St. Elizabeths Hospital (January 1942 to May 1944)*

Diagnosis	Percent	Diagnosis	Percent
Schizophrenia (dementia praecox)	72.0	Psychosis with epilepsy	0.4
Manic depressive psychosis (manic)	8.3	Psychosis with mental deficiency	1.0
Manic depressive psychosis (depressed)	3.4	Paresis .....	.4
Involuntional melancholia .....	.6	Psychosis associated with trauma .....	.6
Paranoia .....	.6	Psychoneurosis .....	.4
Unclassified psychosis	10.3		
Psychopathic personality with psychosis	1.0	Total	100.0
Psychosis with alcoholism	1.0		

The diagnoses of the 500 cases studied are shown in table 1. The striking feature of this grouping is the large number diagnosed as schizophrenic. A similar distribution of diagnoses was found in the group of men that would have been rejected as the result of findings in their social-service histories. In this study there is no evidence that it is easier to eliminate (by social study) one prepsychotic type than another. It should be noted that almost all of the cases studied here are psychotic, and thus any conclusions may not necessarily be applicable to the psychoneuroses.

The distribution of the 500 men as to length of service is shown in table 2. As in previous reports by various authors, the short length of

TABLE 2.—Length of active military service of 500 unselected enlisted men prior to hospitalization at St. Elizabeths Hospital (January 1942 to May 1944)

Length of service	Number of men	Percent	Length of service	Number of men	Percent
Less than 10 days.....	56	11.2	6 to 12 months.....	98	19.6
10 to 30 days.....	46	9.2	1 to 2 years.....	87	17.4
1 to 3 months.....	73	14.6	2 to 4 years.....	44	8.8
3 to 6 months.....	73	14.6	More than 4 years.....	23	4.6
			Total.....	500	100.0

service of the majority of those who become mentally ill is emphasized. Thus 20.4 percent were hospitalized with service of less than 1 month, 49.6 percent with less than 6 months, and 69.2 percent with less than 1 year.

On the basis of the social-service history, an attempt having been made to carefully evaluate the 10 factors previously noted, 178 (35.6 percent) of the 500 men would have been rejected. In table 3 is shown the distribution of these men according to length of active military duty. In this group, as would be expected, is noted an increase in those with only brief periods of service (compare with table 2). Thirty-three and seven-tenths percent had less than 1 month of duty before hospitalization, 69.1 percent less than 6 months, and 84.8 percent less than 1 year. Those with the more obvious mental defects, revealed by the short social histories available, seemed to have a greater chance of becoming mentally ill in a shorter period of time than those whose abnormalities had not been so grossly manifest.

TABLE 3.—Length of active military service prior to hospitalization for a mental illness of 178 enlisted men who would have been rejected for military service on the evidence revealed in their social-service histories

Length of service	Number of men	Percent	Length of service	Number of men	Percent
Less than 10 days.....	31	17.4	1 to 2 years.....	21	11.8
10 to 30 days.....	29	16.3	2 to 4 years.....	5	2.8
1 to 3 months.....	33	18.5	More than 4 years.....	1	.6
3 to 6 months.....	30	16.8			
6 to 12 months.....	28	15.7	Total.....	178	100

The major reasons for the rejection of the 178 men are shown in table 4. Those who had been previously hospitalized because of a mental illness or who showed definite evidence of a pre-existing psychosis or severe neurosis were rejected on that evidence along. Other rejections were made, not because of a single behavior abnormality or personality defect, but only when an individual had displayed a number of such abnormalities, suggesting a grossly unstable personality which had never been able to effect an adequate social adjustment. The same individual, therefore, may be listed under several categories in table 4.

TABLE 4.—*Major reasons for the rejection for military service of the 178 men under study*

Reason for rejection	Number rejected	Percent rejected
Previous hospitalization for mental illness.....	38	21.3
Previous psychotic episodes (not hospitalized but under physician's care).....	16	9.0
Previous psychotic episodes (no medical care received).....	46	25.8
Convulsive states.....	7	3.9
Chronic alcoholism.....	19	10.7
Severe psychoneurotic traits.....	31	17.4
Mental deficiency.....	22	12.3
Markedly peculiar personality.....	22	12.3
Enuretic at time of induction.....	14	7.9
Previous criminal record.....	15	8.4
Inability to adjust in school.....	50	28.0
Chronic behavior problem in community.....	10	5.6
Illiterate.....	3	1.7
Previous suicidal attempts.....	7	3.9
Previously discharged from military service (bad conduct, inaptitude, and for neuropsychiatric defects).....	8	4.5
Previously rejected as unfit for military service.....	3	1.7
Miscellaneous (recent pulmonary tuberculosis, severe birth injury with residual defects).....	2	1.1

It is of interest to note that of the 178 rejected, 100 (56.2 percent) were considered to have had definite psychotic episodes prior to induction. Of these, 6 had had more than one previous mental hospitalization (2 men had each been committed to mental hospitals on three previous occasions), 2 had been treated with insulin shock, 1 with electric shock, and 1 had received insulin shock followed by a prefrontal lobotomy. At the time of their previous hospitalizations, 22 were diagnosed as schizophrenic, 6 as manic-depressive, 1 as paretic, 3 as alcoholic, while 6 were either unclassified or the diagnosis was not available. Of those hospitalized previously, 81 percent became ill again before they had served a year on active military duty. At the present time it is our opinion that the history of a previous hospitalization for a mental illness, or the existence of any such illness of great enough severity to require prolonged psychiatric care or discontinuance of normal activities for any length of time, are adequate reasons for rejection for military service.

It seems clear on the basis of other observations as well as this small study, that even with adequate social-service histories only some of those men who will develop a severe mental illness soon after their entry into military life can be detected and eliminated at the induction centers. We must acknowledge that as yet we have no very accurate means for complete evaluation of the potentials of the human personality. We cannot hope to identify all those who will at some time suffer a mental disability, any more than we can predict accurately which man will distinguish himself under the strain of some military emergency. There may be a "breaking point" for every man, a point at which the personality retreats before the attacks made upon it and seeks refuge in the cloak of a psychosis or other mental

disturbance. With our present skills and means of measurement such a "breaking point" can be foreseen in only a comparatively few men. Yet we should devote every energy to the elimination of those who will become incapacitated after only a short period of service. If one-third of these can be detected (35.6 percent in this study), the use of the social-service history would seem quite justified.

Much of our emphasis during the early months of the war has been on the problems of induction, and the psychiatrist has worked to identify and eliminate the potential psychiatric casualty, and to facilitate his service discharge. These are important functions, but as the list of neuropsychiatric casualties increases and greater numbers of such men return to civil life, we become increasingly aware of the problems incident to that return. Such problems are by no means solved by discharge alone, as the psychiatric patient is notorious for his tendency to require prolonged hospitalization, to suffer a recurrence of his illness, and in many cases to become a public charge. It is becoming increasingly important to turn our attention to the problems of treatment and rehabilitation, hoping to aid him who has been mentally ill in making a satisfactory social adjustment that will enable him to maintain himself without constant resort to public aid.

SUMMARY

1. A study was made of 500 unselected psychotic Navy, Marine, and Coast Guard enlisted men admitted to St. Elizabeths Hospital, Washington, D. C., from January 1942 to May 1944.

2. Social-service data in each case were reviewed to determine how many of these men would have been rejected at the time of induction had such data been available then.

3. On the basis of findings in the social-service histories 178 (35.6 percent) of the 500 men would have been rejected for military service.

4. Of these 178 men, 100 (56.2 percent) were found to have had previous psychotic episodes prior to induction, 21 percent having been previously hospitalized because of a severe mental illness.

5. It is believed that a social-service history would be a valuable adjunct to the psychiatric examination made at the induction center.

6. The need for the early elimination of the potential psychiatric casualty is emphasized by the short period of service such patients have before their entry to a hospital (69.2 percent less than 1 year), the length of hospitalization required, and the great difficulties encountered in rehabilitation.

THE CANCER PROBLEM IN THE NAVY

A Commentative Analysis of Types and Primary Anatomical Sites

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With the increase in naval personnel it is apparent that many medical officers will be faced with the problem of diagnosing and treating a variety of neoplastic diseases whose primary foci are located in various anatomical sites. Many cases of advanced cancer are seen although the importance of early diagnosis and prompt effective treatment is common knowledge. In reviewing the history of such cases it is strongly suggested that cancer was not suspected until the clinical findings were all too obvious. It is not unreasonable for a medical officer to assume that neoplastic diseases are uncommon in healthy males, who comprise the majority of active naval personnel. Hence, the principal purpose of this article is to analyze briefly the more common types and primary anatomical sites of cancer in hopes that greater alertness and efforts to procure an immediate diagnosis of a suspected lesion will be practiced.

SOURCE OF MATERIAL

The material for this article has been obtained from the records of 504 patients who were admitted to the United States Naval Hospital, Brooklyn, N. Y., and covers 4 years, 1941 through 1944. With the exception of 11 cases of personnel from allied services, only those cases among active male U. S. Navy and Marine personnel are included. It is believed that the inclusion of cases of female and retired inactive personnel, dependents, and veterans would be of little value to most medical officers. All patients who were treated as out-patients are also omitted since their complete records are not available for the 4-year period. It is estimated that all those excluded would add 20 to 25 percent to the total. Included are cases of benign giant-cell tumors of bone and mixed tumors of salivary-gland origin. While such lesions are not malignant or true cancers in that they do not metastasize, occasionally a giant-cell tumor will undergo malignant change. Moreover, the tendency of both types of tumors to local recurrence is so common that for practicable purposes they are comparable to basal-cell epithelioma and hence are locally malignant. The inclusion of these cases adds 16 to the total, of which 11 were mixed tumors and 5 were giant-cell tumors.

ANNUAL INCIDENCE

The annual incidence of cancer cases admitted to the United States Naval Hospital, Brooklyn, N. Y., has shown a very definite increase during the 4-year period. It has risen from 43 in 1941 to 251 in 1944, an increase of 484 percent. (See table 1.) With few exceptions this increase has been general among the primary anatomical sites of disease and, therefore, is probably relative to the increase in naval personnel.

TABLE 1.—*Demonstrating increase in new patients and anatomical distribution during the four years, 1941 through 1944*

Anatomical Site	1941	1942	1943	1944	Total
Skin.....	13	7	31	53	104
Digestive system.....	11	15	34	45	105
Respiratory system.....	1	3	8	10	22
Genito-urinary system.....	8	9	31	52	100
Blood and lymphatic systems.....	6	13	29	51	99
Skeletal system.....	1	2	11	18	32
Subcutaneous tissues.....	2	0	11	10	23
Nervous system.....	0	0	2	5	7
Thyroid gland.....	0	1	1	4	6
Miscellaneous.....	1	0	2	3	6
Totals.....	43	50	160	251	504

An important factor which does not appear in this table is the observed prevalence of cancer during a given year. Thus, in addition to the new patients there are those who are either carried over or readmitted with recurrent disease. It is estimated that about one-third of the annual admissions fall into this group, a fact which emphasizes the long period of hospitalization necessary in their treatment as well as the accumulation of cancer cases from year to year.

Inasmuch as the number of personnel from which these patients were drawn is unknown, no estimate as to the probable annual incidence of cancer can be made. It is apparent, however, that even if the present annual incidence should remain constant, the accumulation over a period of a few years will present a major problem.

SKIN

The malignant cutaneous lesions have shown only a relative increase. This is probably due to the fact that many lesions in this group, particularly those of the basal-cell types, were treated as ambulatory patients and hence are not included. The following distribution of cases according to histological structure is noted:

Basal-cell epithelioma.....	63
Squamous epithelioma.....	7
Melanoma.....	33
Mycosis fungoides.....	1
Total.....	104

Basal-cell epithelioma.—These well-circumscribed and superficial lesions were by far the most common type of skin cancer. They appeared as scaly or crusty lesions with or without a central ulceration and were mainly about the face. With few exceptions basal-cell epitheliomas were seen early and presented no particular problem. The exceptions were principally recurrences after treatment and a few cases in which there was extension to bone or cartilage. While the prognosis in these slow-growing and nonmetastasizing cancers is unusually good, delay in treatment or inadequate treatment may necessitate radical therapy and plastic procedures requiring long periods of hospitalization.

Squamous-cell epithelioma.—These lesions, comprising a relatively small but important group, appeared on the face, back, neck, and dorsum of the hands. They were treated for the most part by wide surgical excision. In the initial and follow-up examination it should be recalled that squamous-cell epithelioma may metastasize to regional lymph nodes.

Melanoma.—The number of these highly malignant growths has shown a definite increase during the 4-year period and presents an unpredictable and difficult problem. Too frequently patients with widespread metastases gave a history of having had a pigmented mole "burned off" months or even years before admission. Twelve of the 33 patients are already dead and 5 have distant metastases. Many of the remainder, clinically free of disease, have been observed less than 1 year. It is apparent that the indiscriminate treatment of pigmented cutaneous lesions without biopsy or histological studies of excised specimens is to be thoroughly condemned.

The primary site of the melanomas was widespread from the scalp to the toe. One apparently arose in the spinal meninges, another in the eye. The primary of a third patient having axillary metastases is unknown; repeated questions and physical examinations have not revealed it.

The single case of mycosis fungoides requires no comment.

DIGESTIVE SYSTEM

This group will be divided into two major parts because it is composed of all structures which are involved in the intake and digestion of foods as well as the elimination of food waste.

PART I. UPPER DIGESTIVE TRACT

Cancers of the upper digestive tract, which is concerned primarily with the intake of foods, were either squamous or its variant, epidermoid, in type, with the exception of tumors of the parotid salivary gland. The distribution is as follows:

Lower lip.....	40
Alveolar ridge.....	2
Floor of mouth.....	2
Tongue.....	2
Palate.....	2
Epiglottis.....	1
Esophagus.....	3
Parotid gland (cancer).....	4
Parotid gland, mixed, benign.....	11
Total.....	67

Lower lip.—Almost two-thirds of the 67 cancers in this group originated in the mucous membrane of the lower lip, an area visible and easily accessible to examination and treatment. Most of these lesions were seen early and appeared clinically as either chronic shallow ulcers or as localized keratotic thickening with little basal induration. Although lip cancers in general tend to grow slowly and metastasize relatively late, it seems safest to biopsy all suspected lesions. The most advanced cancer in this group appeared in a man of 32 who had had a previous luetic history. In spite of the fact that repeated Kahn reactions and dark-field examinations were negative, this man was given antiluetic therapy in addition to local medication for a period of about 1 year. During this time the lip lesion grew to the extent of forming a sloughing ulceration involving two-thirds of the lower lip. In retrospect it seems that it would have been relatively simple to have removed a small marginal wedge for biopsy. Hence, it is obvious that a biopsy should be taken in the absence of a positive dark-field examination even though coexistent syphilis may be present.

Tongue, floor of mouth, alveolar ridge, palate, and epiglottis.—These structures about the oral cavity and pharynx were less frequently involved than had been suspected. Although small in number, the lesions presented many difficulties in treatment and a poor prognosis followed. Both of the patients with tongue cancer are dead while one each of the patients with cancer on the floor of the mouth, on the palate, and on the alveolar ridge also died of metastatic disease. For the most part the cancers first appeared as chronic ulcerations having well-defined and rigid edges and occurred in personnel from 40 to 50 years of age. Several were initially suspected by dental officers and this emphasizes the important role of that profession in the diagnosis of intra-oral neoplasms.

Esophagus.—The three cases in this group were all advanced and pursued a rapidly fatal course.

Tumors of the parotid salivary gland.—These tumors deserve special consideration because of their relative frequency and because they are so often mistreated. There were 4 cancers and 11 benign mixed

tumors. Clinically one cannot distinguish one from the other. Although sialographs may offer reliable clues, aspiration biopsy is believed to be the most important means of establishing a preoperative diagnosis. Because of the potential danger of postoperative facial paralysis it becomes clear that these lesions require more than casual consideration. The symptomless long history and encapsulated appearance are often misleading as to the true nature and extent of these lesions.

PART II. DIGESTIVE ORGANS AND LOWER ALIMENTARY TRACT

The adenocarcinomas of the digestive organs and lower alimentary tract were distributed as follows:

Stomach.....	8
Liver.....	2
Pancreas.....	2
Cecum.....	1
Colon.....	5
Sigmoid and rectum.....	20
Total.....	38

Stomach.—Considering the fact that this survey covers a 4-year period, the number of patients with gastric carcinoma is relatively small. With one exception all of these patients were over 40 years of age and initially presented the usual and misleading symptoms of indigestion. The present frequent use of roentgenological procedures supplemented by gastroscopy will doubtless detect an increasing number of gastric cancers in their early stages.

Liver and pancreas.—Recent advances in surgery offer some hope for sufferers of pancreatic carcinoma. There is, however, little to be said or done for the victims of primary cancer of the liver. Fortunately, both types are uncommon.

Cecum and colon.—Persistent alterations in bowel habits, with or without bloody stools, apparently received considerable attention. Hence, a relatively large number of patients in this group, as well as those in the following group, presented operable lesions. Particular credit must go to the medical officers who have separated these few cases from the tremendous number of personnel complaining of gastro-intestinal disturbances from environmental changes and other causes.

Rectosigmoid and rectum.—Contrary to many opinions, this is not a disease of middle or late adult life. Eight of the twenty patients were under 35 years of age and one was only 19 years old. Ample emphasis has been placed on digital and proctoscopic examinations of the rectum and the rectosigmoid for such complaints as sacral pain, blood or mucous in the stool, persistent constipation or diarrhea,

particularly a watery diarrhea, and a sense of fullness in the rectum. Much more emphasis should be placed on the fact that small lesions in these areas are difficult to demonstrate by barium-enema examinations.

RESPIRATORY SYSTEM

The total number of these patients was surprisingly small, a fact emphasizing the wide variation between civilian statistics and those limited to males of military age. The cases are distributed as follows with reference to anatomical sites:

Maxillary sinus.....	1
Nasopharynx.....	7
Larynx.....	3
Lung.....	7
Thymus.....	2
Pleura.....	2
Total.....	22

Maxillary sinus.—The single case in this group presented no unusual features. The lesion was discovered relatively early and treated by radical surgery without supplementary x-ray therapy.

Nasopharynx.—These seven cases comprise almost one-third of the total number of malignant tumors of the respiratory system. Three of this number are already dead and the remaining four are still hospitalized. Five of the cases were initially diagnosed from a metastatic neck node. It is apparent that these tumors, whether anaplastic carcinomas or lympho-epitheliomas, are prone to develop early metastases and initially give rise to rather mild and vague local symptoms which are easily mistaken for the usual chronic infections around the nasal passages. In review, the histories indicated the following symptoms: Progressive obstruction of the nasal passage, usually unilateral; a recurrent bloody nasal discharge, never a true hemorrhage; and pain not infrequently referred to the ear. It would seem that, while such symptoms are not diagnostic, failure to respond to the ordinary therapeutic measures should prompt one to examine the nasopharynx for a reddish, friable tumor.

Larynx.—All of the cases of laryngeal carcinomas involved the intrinsic larynx. These lesions were diagnosed reasonably early because of persistent hoarseness.

Lung.—Although primary cancer of the lung is authoritatively stated to be increasing and to comprise from 5 to 15 percent of all cancers, it is still a very uncommon disease before the age of 35 years. This may, in part, account for the fact that there were only seven cases in this group. Four of these were admitted during the last year of this survey and it is possible that this number may show a significant increase in the future. It is hoped that bronchoscopic examinations

may become more frequent, particularly in middle-aged personnel who have a persistent cough with occasional blood-tinged sputum that is negative for specific organisms.

Thymus.—These are extremely rare cancers and in this series were diagnosed only from post-mortem findings.

Pleura.—Primary malignant tumors of the pleura are likewise uncommon. The first case was classified as a mesothelioma and found to be inoperable. The second case was reported histologically as being a pleural endothelioma. This tumor, although of considerable size, was resected along with four ribs. While experience in this field is extremely limited, it would seem that possible cures, even of relatively large tumors, may follow radical thoracic surgery.

GENITO-URINARY SYSTEM

During the 4-year period there was a total of 100 cancers involving the genito-urinary system. They were located anatomically as follows:

Testicle.....	73
Bladder.....	16
Kidney.....	3
Prostate.....	5
Penis.....	1
Urethra.....	1
Adrenal cortex.....	1
Total.....	100

Testicle.—The highly important cancers of the testicle have shown a 1,200 percent increase during the 4-year period. Thus, in 1941 there were 3 patients, comprising 7.2 percent of the cancer admissions during that year, while in 1944 there were 40 patients, representing 15.9 percent of the total of 251 cases. Further, of the 504 cases the 73 tumors of the testicle (14.5 percent) exceeded those of any other single organ. Generally, cancer of the testicle is relatively uncommon and is stated to comprise about 0.6 percent of all malignant tumors in men.

Unfortunately, a complete morphological classification cannot be included. It is important, however, to note that a vast majority were either embryonal carcinomas or seminomas, types which are prone to rapid metastases by the lymphatics and the blood stream. Hence, temporizing and conservative treatment of a testicular enlargement should be practiced to a minimum. If one chooses to temporize, he should certainly be aware of the fact that the average patient in a series of 28 unselected cases had been seen by three medical officers before a teratoma was suspected and that various kinds of local and systemic treatment were tried over periods ranging from weeks to several months.

The initial complaint is usually a painless nodular or smooth enlargement of the testicle. A "dragging sensation" may be experienced as the size of the organ increases. About 10 percent of the cases will show varying amounts of fluid in the tunica vaginalis. Associated gynecomastia has not been uncommon in this series of cases. Systemic disturbances are minimal but, when present, strongly suggest metastases. Prolan determination of 24-hour urine specimen is an important diagnostic aid as well as a valuable follow-up procedure.

Bladder and kidney.—The number of bladder and kidney neoplasms is fairly well-distributed over the 4-year period and has shown only a slight increase. About one-half of the bladder lesions were the relatively benign papillary carcinomas and presented no special problems. In most instances the principal complaint of hematuria was promptly investigated.

Prostate.—Unfortunately the initial symptoms of prostatic cancer are mainly apparent in either advanced local disease or metastases. However, particular attention to alterations in the size, shape, and consistence of the prostate gland during routine rectal examinations of males over 40 should lead to the detection of early cases.

Penis, adrenal cortex, urethra.—The single cases of penile and adrenal-cortex carcinoma presented no remarkable features. Cancer of the urethra is an extremely rare disease. Occurring in a 32-year-old motor machinist mate, this lesion was believed from histological studies to originate in the glands of Cowper. It extended clinically along the entire urethra and fungated through the meatus.

BLOOD AND LYMPHATIC SYSTEMS

The lesions of this group are of considerable importance because of their relative frequency and their almost invariably fatal prognosis. The possible exceptions are those cases of lymphosarcoma originating in specific organs rather than being primary to the lymph nodes. In this series of cases there were three exceptions, the primary foci of which were located in the tonsil, the spinal meninges, and the base of the tongue respectively.

Significant increases are present in all groups. Thus, in 1941 there were 3 cases each of Hodgkin's disease and lymphosarcoma while in 1944 there were 28 cases of Hodgkin's disease and 14 of lymphosarcoma. No cases of leukemia were recorded in 1941 but 3 cases of lymphatic leukemia and 6 of myelogenous leukemia were admitted in 1944.

Aside from the fatal prognosis, the malignant lymphatic diseases in many patients pursue a chronic course over a period of several years. Hence, there are intervals when the patients are able to and do perform limited duty. Two individuals of this group have been

on active-duty status for 3 and 2 years respectively. Hospitalization has not been necessary during this time although both have received a few x-ray treatments as ambulatory patients.

The cases are distributed as follows with reference to histological types:

Hodgkin's disease.....	49
Lymphosarcoma.....	32
Leukemia.....	15
(a) Acute lymphatic.....	3
(b) Chronic lymphatic.....	2
(c) Acute myelogenous.....	5
(d) Chronic myelogenous.....	5
Lymphoma (mediastinal).....	3
Total.....	99

Hodgkin's disease.—This most common of the malignant diseases of the lymphatic system presents a difficult diagnostic problem. The vast majority of these patients complained of a painless swelling of a node or a group of nodes, usually in the neck, accompanied by asthenia, malaise, loss of weight and, frequently, a remittent fever. In general, the number of systemic disturbances was decidedly out of proportion to that of the demonstrable diseases. On the other hand, where the initial complaints were due to enlarged mediastinal nodes, pressure symptoms such as cough, dyspnea, dysphagia, and facial edema were the presenting features. In a single case, where the skeletal system was the principal site of the disease, the patient's first symptoms were due to the collapse of a dorsal vertebra.

It is clear that the variety of symptoms and clinical findings may resemble those of a great number of diseases. Hence, the problem arises of when to observe, treat conservatively, or remove a node for biopsy. Certainly no fixed rule can be followed but the advisability of removal of a node for biopsy seems indicated when a careful work-up fails to establish a definite diagnosis. In the selection of a node for removal, the neck nodes are decidedly preferable, those in the groin least preferable because of less chance of infection and more chance of finding the nodes most apt to show disease.

Lymphosarcoma.—Again the principal finding is a painless enlargement of a lymph node or lymphoid structures, with symptoms relative to the area or organs involved. Although systemic disturbances are usually less than in the average case of Hodgkin's disease, the two diseases can be accurately differentiated only by histopathological studies.

Leukemia.—This is primarily a disease of the blood and blood-forming organs and occurs in many forms, but only the lymphatic and myelogenous types were seen in this series of cases. Both of

these types run an acute and chronic course. There is little beyond supportive treatment for the febrile and rapidly fatal acute cases, of which there were eight. The chronic cases may survive several years. The blood studies are usually diagnostic, but should be supplemented by sternal-marrow biopsies. While there may be some doubt as to how long one can prolong life by treatment, there is definite evidence that x-ray therapy or the oral administration of radioactive phosphorus or sodium will relieve distressing symptoms temporarily.

Lymphoma.—These three patients with undiagnosed mediastinal enlargements are included mainly because the clinical and radiographic evidence seems to indicate that they are due to either Hodgkin's disease or lymphosarcoma.

SKELETAL SYSTEM

There has been a notable increase in the number and variety of malignant bone tumors. Only 1 patient was admitted in 1941, while 18 were admitted in 1944. These tumors all have the common symptom of pain and radiographic evidence of an alteration of the involved bone. A local swelling is usually but not always present.

Based on a histological analysis the 32 cases are divided as follows:

Osteogenic sarcoma.....	15
Ewing's tumor.....	3
Myeloma.....	4
Chondrosarcoma.....	1
Angiosarcoma.....	1
Sacroccygeal chordoma.....	1
Metastatic cancer of undetermined origin.....	2
Giant-cell tumor.....	5
Total.....	32

Osteogenic sarcoma.—This, the largest group of malignant bone tumors, has shown a decided increase. Thus, 8 of the 15 cases were seen during 1944. Anatomically the tibia was involved 8 times, the femur 4, the ilium, humerus, and skull (occipital bone) once each.

It is clinically significant that the ends of the bones were usually involved and with one exception the site in the cases involving the lower extremity was just above or below the knee joint. A persistent, boring pain with or without a swelling and not relieved by ordinary measures should be investigated. A history of injury should not preclude such investigation because many of the patients associated the onset of symptoms with trauma. Further questioning, however, revealed that the injury may have directed attention to a pre-existing lesion. Thus, several patients sought to associate the onset with striking the knee while jumping obstacles. It was subsequently revealed that the leg "gave way" and hence that some area about the knee was struck.

While not always diagnostic, radiographs are most important in detecting an osteogenic sarcoma. Supplementary aspiration biopsies or significant increases in the serum alkaline phosphatase are valuable diagnostic aids.

Ewing's tumor.—In the three patients with endothelial myelomas the primary lesion was located in the femur, rib, and iliac bones. This tumor seems to have been suspected more often than any other but most of the cases proved on biopsy to be either inflammatory or an eosinophilic granuloma of bone. Such mistaken impressions seem logical when one considers the descriptions of Ewing in that localized pain and temperature are the most common symptoms with radiographic evidence of a destructive bone area. It should be pointed out that multiple areas are frequently involved.

Myeloma.—There were three patients with extensive punched-out areas of bone destruction, a characteristic of multiple myeloma. Contrary to the usual conception that this disease occurs mainly in late adult life, the ages of these patients were 19, 23, and 32 years respectively.

The single case of solitary myeloma involved the iliac bone. After a year the patient has shown no radiographic or clinical evidence of disease elsewhere.

Chondrosarcoma and angiosarcoma.—Only a single case of each of these types was observed. The chondrosarcoma involved the ilium, was inoperable when diagnosed, and grew to an enormous size before proving fatal. The case of angiosarcoma was diagnosed from an aspiration biopsy. The initial symptoms were due to a pathological fracture of the surgical neck of the femur. Subsequent x-rays of the skeletal system demonstrated a large destructive tumor involving a rib and extending into the thoracic cavity. For a period of 21 months disease extension has been controlled by x-ray therapy to the extent that the patient does limited duty about the hospital.

Sacroccygeal chordoma.—Although not strictly a bone tumor, this single case of chordoma is included because of extensive destruction of the sacrum. There were mild neurological symptoms and examination revealed a large extra-rectal tumor.

Metastatic cancer of indeterminate origin.—It is commonly recognized that first clinical appearance of a cancer may be metastases to bone. Particularly prone to early skeletal metastases are those cancers primary to the breast, prostate, thyroid, and kidney.

In the first of these patients there was a destructive lesion of the sternum. From biopsy studies and other evidence it was believed but not proven that the primary was located in the kidney.

The second patient presented the most unusual feature of having the terminal phalanx of the thumb as the initial clinical site of disease.

Biopsy of this was reported cancer. Subsequently a destructive lesion of the tibia has been demonstrated by x-rays, and a node removed from the supraclavicular space was reported to show adenocarcinoma. Repeated clinical and radiographic studies have failed to disclose the primary.

Giant cell tumors.—As previously stated, these are benign new growths but they are included because of their tendency to recur and, in rare instances, to become malignant.

Commonly appearing as a mildly painful and expansile swelling located in the region of the epiphyseal line, the tumors in this group involved the tibia, fibula, humerus, sacrum and os calcis. The x-rays are usually characteristic and demonstrate an area of bone absorption. Bony trabeculations may be seen distributed throughout the involved region, thus giving rise to the so-called "soap bubble" appearance.

SUBCUTANEOUS TISSUES

The malignant tumors of the soft parts comprise a complex group of sarcomas originating in nerve, fat, muscle, synovial membranes, and fibroblastic tissues. Their importance is not to be minimized because they are difficult to remove completely and, in general, their treatment leaves much to be desired. Thus, 11 of the 23 patients are known to be dead and 3 are living with hopelessly advanced metastatic disease.

These tumors commonly appear as symptomless, subcutaneous swellings with a history of being present for a long time but only recently showing active growth. Even when surgically exposed, they may seem well-circumscribed or show only limited infiltration, thus leading one further to an erroneous conclusion and limited treatment when more radical measures are necessary.

In the more malignant types metastases are common and with few exceptions are blood-borne.

Althout sometimes difficult to classify from histological studies, the cases are distributed as follows:

Neurogenic.....	9
Synovioma.....	6
Fibrogenic.....	4
Myogenic.....	3
(a) Smooth muscle.....	2
(b) Striated muscle.....	1
Lipogenic.....	1
Total.....	23

Neurogenic sarcoma.—The sarcomas originating in peripheral nerve structures constituted the largest group. Anatomically some portion of the upper extremity was involved in five instances, the lower extremity in three, and the upper lip once. There are no

definite diagnostic features for these tumors, and the clinical relationship to nerve distribution is often too vague to be of significance. Likewise, the presence of *cafe au lait* spots or other evidence of von Recklinghausen's disease was often lacking.

Synovioma.—Malignant tumors originating in the synovial membranes are considered to be uncommon. Hence, the large number in this series was totally unexpected. Appearing near or about the joints, these new growths are prone to early metastases by both the lymphatic and vascular systems.

The poor prognosis is evidenced by the fact that four patients have died and the remaining two have hopelessly advanced disease. In three instances amputation for lesions below the ankle joint was soon followed by pulmonary metastases. A fourth patient with a lesion above the ankle was treated by wide local excision and is still living with both pulmonary and regional inguinal node metastases. The fifth patient has advanced inoperable axillary metastases from a primary about the wrist and a sixth died from pulmonary metastases and a fungating lesion involving the hip.

Fibrosarcoma.—These four patients were treated by wide local excision and, when last seen, were clinically free of disease. The primary sites were the sole of the foot in two instances, the upper arm in the third, and the lower part of the arm in the fourth.

Myogenic and lipogenic sarcoma.—From an insidious onset to a rapidly fatal termination these new growths were unsuccessfully treated by surgery and irradiation. A striated muscle of the back and a smooth muscle of the bladder wall and terminal ileum were the primary sites of the myogenic sarcomas. The single case of lipogenic sarcoma originated in the space of Retzius.

CENTRAL NERVOUS SYSTEM

There were five patients with primary malignant lesions of the central nervous system. Two cases of neuroblastoma, one primary in the suprarenal gland and the other arising in the left retro-orbital space, are included because of similar histology although not actually a part of this group.

Human cancer involving the central nervous system presents vague neurological disturbances which are difficult for the inexperienced observer to interpret. While a medical officer may suspect the presence of such a lesion, the diagnosis and treatment usually require the services of a specialist in this particular branch of medicine.

The brain was involved in three instances: First, a fibrillary astrocytoma of the cerebrum; second, a spongioblastoma multiforme, located near the fissure of Rolando and giving rise to a hemiplegia; and third, a rapidly fatal meduloblastoma, involving the cerebellum.

The 2 patients with primary lesions of the spinal cord had progressive motor and sensory disturbances of the lower extremities. The tumors in both were inoperable and from biopsy specimens were reported to be a sarcoma of the meninges and a neuroblastoma.

THYROID

Four of the 6 patients with cancer of the thyroid gland were admitted during 1944. This indicates only a relative increase, constituting 1.5 percent of the cases during that year compared with a 1.2 percent incidence for the 4-year group.

Although limited in number, these cases warrant a much greater consideration than others. First, it is generally recognized that the early diagnosis of thyroid cancer is extremely difficult and that the initial lesion frequently appears as an innocent nodule whose true nature is discovered only by histological examination after removal. Second, the thyroid gland ranks high as the site of an obscure primary. Thus, with the primary metastasizing by both the blood stream and the lymphatic system, skeletal or cervical node metastases may be the initial clinical findings.

In this group of patients the disease was limited to the thyroid gland in two instances. In the other four there were extracapsular extensions and metastases to regional neck nodes that required radical treatment.

MISCELLANEOUS

Because of obscure clinical features and vague histological structure, six cases were placed in a miscellaneous group. There were two patients whose cases were diagnosed as endothelioma. In one of these the lesion was localized and involved the peritoneum near the cecum. It apparently was not a carcinoid. The other patient had a subcutaneous tumor removed from the right anterior abdominal wall. Both lesions were excised locally and after 1 year there was no evidence of locally recurrent or metastatic disease. Hence, there may be a justified doubt as to whether these tumors were truly of malignant nature.

There were three cases of retroperitoneal sarcoma. One patient died from disease which was reported to be a myxolipoma-sarcoma. A second patient, still living after 2 years, is without evidence of clinical disease from an unclassified sarcoma. A third patient, whose diagnosis was made on an aspiration biopsy through the perineum, is living, but with disease. The aspirated material was reported to show a highly malignant sarcoma of a type unclassified. After intensive x-ray therapy the lesion has remained fixed and bulky.

The final case in this series was that of a malignant and embryonal tumor showing extensive involvement of the left axilla. It was said

to be a carcinoma, possibly arising in axillary sweat glands. Extensive and repeated studies have failed to disclose a possible primary lesion elsewhere. This patient was treated by a radical axillary dissection and post-operative x-ray therapy, and is clinically free of disease after 1 year.

COORDINATION OF TREATMENT

The limited time of observation does not permit an evaluation of the various therapeutic methods in terms of 5-year survivals. Equally important, however, is the status of present treatment. Thus, a rational basis for intelligent planning of treatment is related directly not only to the early recognition of the disease, but to proper coordination of all treatment. This is frequently difficult when the patient is partly treated in widely separated hospitals. It would be ideal but not always practical to have all treatment, whether by surgery, x-ray or radium singularly or in combination, done in a single institution. Fully cognizant of this, the Medical Department of the Navy has designated certain hospitals for the treatment of malignant diseases (Manual of the Medical Department: Pt. I, Ch. 6B, Sec. V, pars. 16B18.1 and 16B18.2).

When patients are transferred, it is particularly important that detailed records as to diagnostic and operative procedures, as well as biopsies, x-rays and postoperative specimens, be forwarded promptly. Treatment has been delayed unnecessarily while waiting for such essential material and data.

COMMENTS

From the present data it is apparent that there has been a substantial increase in cancer patients admitted to the United States Naval Hospital, Brooklyn, N. Y., during the 4-year period, 1941 through 1944. The increase is believed to be consistent with the enormous growth of the naval service during this time.

While many obscure cancers have been observed, it is highly important to note that, contrary to many beliefs, practically all types of cancer do occur in young adults. In the 504 cases, the relative frequency of certain types, such as Hodgkin's disease (9.7 percent), lymphosarcoma (6.3 percent), and basal-cell epithelioma (12.5 percent), was to be expected. Other frequencies, such as teratoma of the testes (14.5 percent) and melanoma (6.5 percent), were totally unexpected.

In general this analysis of types and anatomical sites of cancer in naval personnel reveals a distribution peculiar to males of a relatively young age.

SULFADIAZINE AND PENICILLIN IN THE TREATMENT OF SCARLET FEVER

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Sulfanilamide has been used extensively in the treatment of scarlet fever and tested particularly to determine its efficacy in preventing the many complications which are characteristic of the disease. All observers are agreed that sulfanilamide has no effect on the initial toxic phase of scarlet fever. There is, however, disagreement as to its value in preventing complications. A few reports seem to indicate that sulfanilamide reduces the incidence of complications (1) (2) (3) (4) (5) (6). Other reports have shown no reduction in incidence of complications (7) (8) (9) (10) (11) (12) (13). The recent work on mass chemoprophylaxis (sulfadiazine) in apparently reducing the incidence of scarlet fever (14) (15) prompted us to test its value in the treatment of that disease as reflected by its effect on the appearance of complications.

Three hundred and eighteen patients with scarlet fever were treated from November 1944 through June 1945. Five of these were female members of the staff. The remaining cases were almost entirely trainees who arrived at this base in the Deep South from three main geographical centers: A west coast training school, a north central training area, and a northeastern training station. Thirty-eight were full-blown on the first day of arrival at this activity. One hundred and nine occurred within the first week of arrival. Ninety-four and six-tenths percent of the patients were 17 to 26 years of age and 5.4 percent were 28 to 45 years of age. The incidence of scarlet fever and of complications by months is recorded in table 1.

The results of throat cultures done on 55 patients are shown in table 2. The streptococci were classified according to Lancefield. These bacteriologic studies were done in the laboratory of Capt. Edward D. DeLamater, MC, A. U. S. to whom we are much indebted.

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TABLE 1.—*Incidence of scarlet fever and of complications, by months*

Month	Number of cases	Number complicated	Percent complicated
<i>1944</i>			
November.....	10	5	50.0
December.....	41	21	51.2
<i>1945</i>			
January.....	86	42	48.8
February.....	94	35	37.2
March.....	38	10	26.3
April.....	20	9	45.0
May.....	27	11	40.7
June.....	2	1	50.0

TABLE 2.—*Results of 55 throat cultures*

<i>Classification</i>	<i>Number of cases</i>
Group A.....	
Type 3.....	4
Type 9.....	1
Type 11.....	1
Type 13.....	1
Type 17.....	12
Type 19.....	6
Type 30.....	3
Type 15 and 19 (cross type).....	1
No type.....	2
Group B.....	1
Group C.....	1
Negative cultures.....	15
Culture lost in growth.....	7

Complications were present in 134 out of 318 patients. The complications encountered and their frequency were as follows:

	<i>Number of cases</i>
Arthritis.....	42
Lymphadenitis.....	41
Suppurative otitis media.....	35
Acute myocarditis.....	30
Sinusitis.....	17
Pneumonia.....	7
Tonsillitis.....	5
Peritonsillar abscess.....	4

Attention is invited to the frequency of arthritis and myocarditis. These cases will be reported fully in another paper. Acute myocarditis was diagnosed only when there was electrocardiographic evidence of marked myocardial damage.

Our initial study concerned 132 patients who were treated from November 1944 through January 25, 1945. The first 49 patients served as controls and received no therapy. The next 83 patients received 4 grams of sulfadiazine daily for 5 days. Table 3 records our results.

It is evident on inspection of table 3 that a dose of 4 grams of sulfadiazine daily for 5 days had no prophylactic value in affecting the incidence of complications.

TABLE 3.—*Results of study of 132 patients*

Treatment	Total subjects	Number uncomplicated	Number complicated	Percent uncomplicated
None ¹	49	26	23	53.0
Sulfadiazine ²	83	38	45	45.78
Total	132	64	68	

¹ 4 cases received antitoxin.

² 7 cases received antitoxin. Each patient received 4 grams of sulfadiazine daily for 5 days.

One group of observers had noted an apparent reduction in complications when sulfanilamide was given in larger doses over a 2-week period (5). In order to test the value of this longer method of treatment, 104 scarlet-fever patients were studied from February 19 through June 30, 1945. All but one of these patients were strictly alternated. One patient received 4 grams of sulfadiazine daily for 5 days and the alternate patient received 8 grams of sulfadiazine daily for 10 days and 4 grams daily for the next 4 days. Table 4 indicates the results obtained from the two forms of therapy.

TABLE 4.—*Results of study of 104 patients*

Group	Total subjects	Number uncomplicated	Number complicated	Percent uncomplicated
Control ¹	53	34	19	64.15
Sulfadiazine for 2 weeks ²	51	37	14	72.55
Total	104	71	33	

¹ Received 4 grams of sulfadiazine daily for 5 days. (Shown by table 3 to have no more effect than no therapy.)

² Received 8 grams of sulfadiazine daily for 10 days and 4 grams daily for the next 4 days; 1 case received antitoxin.

Again, on inspection, it is noted that there is a relatively small difference. The result of calculating x/σ for the difference between these two groups was approximately 0.90 which emphasizes that there is no significant statistical difference.¹

In the period which intervened between the two studies just described, a small amount of penicillin, which was then difficult to obtain, was allocated to the medical department for use in the scarlet-fever ward. Sixty-seven patients were studied. Thirty-one received 100,000 units in divided doses during the first 24 hours in the sick bay. Thirty-six patients who served as controls, received 4 grams of sulfadiazine daily for 5 days. Table 5 records the findings.

¹ In statistical analysis the symbol x/σ means the Average Difference divided by the Standard Error of Difference.

TABLE 5.—Results of study of 67 patients

Group	Total subjects	Number uncomplicated	Number complicated	Percent uncomplicated
Control ¹	36	22	14	61.1
Penicillin ²	31	19	12	61.2
Total.....	67	41	26	.....

¹ Received 4 grams of sulfadiazine 4 times daily for 5 days; 1 case received antitoxin.

² Received 100,000 units of penicillin in first 24 hours after admission.

It is permissible to use in control groups patients who received 4 grams of sulfadiazine daily for 5 days, since in our first study (see table 3) it was shown that such a dosage of sulfadiazine was no more effective than no treatment at all. It is evident that 100,000 units of penicillin given over a 24-hour period on admission has no effect upon the incidence of complications. However, this dosage of penicillin is small. Larger doses and varying schedules of treatment should be tried to determine the effect of penicillin on complications.

Of the 318 scarlet-fever patients, 303 were studied with regard to the effect of therapy as noted. Fifteen patients were excluded because of: (1) Questionable diagnoses which were later established as scarlet fever; and (2) idiosyncrasies to sulfadiazine.

COMMENT

The use and abuse of the sulfonamides in infection has been the subject of numerous treatises. With time, the diseases which respond to these drugs have been more clearly defined. Pathologic processes such as localized abscess, empyema, and vegetations on the valves of the heart in subacute bacterial endocarditis, prevent a therapeutic effect on known susceptible organisms because of chemical by-products of the infective process or because of mechanical protection of the micro-organisms. In scarlet fever, Wesselhoeft (11) has expressed the opinion that the streptococci which are responsible for the disease are walled off and protected from the effect of the sulfonamides by the natural forces of resistance which cause fibrin to be thrown into and on the surface of the mucous membrane of the upper respiratory tract and cause superficial phagocytic cells to surround the bacteria.

Wesselhoeft has emphasized the great value of sulfanilamide in reducing the mortality that follows the onset of serious complications in scarlet fever. The majority of these deaths are due to the end results of pyogenic infections which invade the blood stream or meninges. Wesselhoeft believes that drastic chemotherapy is indicated in any desperate, fulminating, highly toxic infection of the faucial space and trachea suggestive of streptococcal infection before any culture reports are obtained. Fox and Hardgrove (16) likewise believe that in scarlet fever sulfanilamide was of greatest value in

treating septic complications such as streptococcemia, meningitis, and surgically inaccessible foci.

In this study we have confined ourselves to the testing of the value of sulfadiazine in preventing complications in scarlet fever. Two types of therapy were used: (1) Small dose (4 grams daily), short time (5 days); and (2) full dose (8 grams daily for 10 days and 4 grams daily for the next 4 days), long time (2 weeks). We found that neither type of therapy altered the incidence of complications. French (13), using sulfanilamide in full doses over a 4-week period, concluded that sulfanilamide has no significant effect upon the initial symptoms of scarlet fever, or upon the kind, incidence, or duration of later complications.

CONCLUSIONS

1 Sulfadiazine does not lower the incidence of complications in scarlet fever.

2. Sulfadiazine should not be used routinely in the treatment of scarlet fever. Its use should be confined to the treatment of particular complications.

3. One hundred thousand units of penicillin given over a 24-hour period immediately after admission does not lower the incidence of later complications. However, this dosage is small. Larger doses with varying schedules, should be tested.

REFERENCES

1. SAKO, W. DWAN, P. F., and PLATOU, E. S.: Sulfanilamide and serum in treatment and prophylaxis of scarlet fever. *J. A. M. A.* 111: 995-997, September 10, 1938.
2. BENN, E. C.: Sulphanilamide in treatment of scarlet fever. *Brit. M. J.* 2: 644-646, September 23, 1939.
3. SILVERMAN, A. C.: Sulfanilamide in treatment of scarlet fever; need for research point of view. *New York State J. Med.* 40: 317-325, March 1, 1940.
4. THENEBE, C. L., HIRSHBERG, M. S., and BOBROW, A.: Three hundred and fifty cases of scarlet fever treated with sulphanilamide and neoprontosil. *J. Connecticut M. Soc.* 3: 351-353, July 1939.
5. GORDON, M. B., SOLOMON, N. H., and PEARLMAN, S. F.: Value of sulfanilamide and scarlet fever antitoxin in treatment of scarlet fever. *J. Pediat.*, 19: 76-84, July 1941.
6. BOZALIS, G. S. and BARNETT, H. L.: Sulfanilamide in treatment of scarlet fever. *J. Missouri M. A.* 37: 137-142, April 1940.
7. ULRICH, H. J. and YOUNG, T. R.: Sulfanilamide and complications of scarlet fever. *J. Missouri M. A.* 36: 445-447, November 1939.
8. WOLF, A. M. and LEVINSON, S. O.: Sulfanilamide and convalescent serum in scarlet fever. *Illinois M. J.* 79: 239-241, March 1941.
9. WESSELHOEFT, C. and SMITH, E. C.: Use of sulfanilamide in scarlet fever. *New England J. Med.* 219: 947-953, December 15, 1938.
10. SCHWENTKER, F. F. and WAGHELSTEIN, J.: A note on the use of sulfanilamide in scarlet fever. *Baltimore Health News* 15: 41-46, June 1938.

11. WESSELHOEFT, C.: Sulfanilamide in management of acute streptococcal, particularly scarlatinal, infections of upper respiratory tract. *New England J. Med.* 224: 221-226, February 6, 1941
12. TOP, F. H. and YOUNG, D. C.: Treatment of moderately severe scarlet fever, study of alternate patients treated with sulfanilamide, convalescent serum and scarlet fever antitoxin. *J. A. M. A.* 117: 2056-2060, December 13, 1941.
13. FRENCH, J. O.: Sulphanilamide treatment of scarlet fever. *J. Hyg.* 39: 581-596, September 1939.
14. WATSON, R. F., SCHWENTKER, F. F., FETHERSTON, J. E., and ROTHBARD, S.: Sulfadiazine prophylaxis in epidemic of scarlet fever. *J. A. M. A.* 122: 730-733, July 10, 1943.
15. COBURN, A. F.: Control of streptococcus hemolyticus. *Wellcome Prize Essay, Mil. Surgeon.* 96: 17-40, January 1945.
16. FOX, M. and HARDGROVE, M.: Scarlet fever therapy; comparison of convalescent serum and sulphanilamide. *Am. J. M. Sc.* 199: 495-498, April 1940.



SECTIONING FOR THE ELECTRON MICROSCOPE ACCOMPLISHED BY THE HIGH SPEED MICROTOME

Summary.—High-speed microtome sectioning of biological material is described. It is possible to produce sections a fraction of a micron in thickness. These are thin enough to be used in the electron microscope. Sections of the usual thickness for the light microscope can also be obtained. Methods of tissue fixation and embedding are given.

The use of a new class of embedding materials which volatilize by sublimation and which eliminate the drawback of extraction by solvents is described. The novel possibility of using ice for embedding and slicing purposes may open some new phases of microscopical research.

A number of micrographs are given which illustrate the successful technique of high-speed microtome sectioning as well as the necessary auxiliary techniques, particularly fixation, embedding, and section collecting. The figures indicate some of the fields of application of the new microtome.—GESSLER, A. E. and FULLAM, E. F.: Sectioning for electron microscope accomplished by high-speed microtome. *Am. J. Anat.* 78: 245-279, March 1946.

PENICILLIN-STERILE EMPYEMA

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Penicillin therapy has modified the clinical course of pneumonia and its complications, and posed new problems in the treatment of pleural infection and inflammation. The recent literature contains frequent discussions of such problems (1), (3), (4), (5), (6), (7), (8), (9), from which varying conclusions may be drawn. We have observed a small group of postpneumonic empyema patients with somewhat unique common characteristics to which the term "penicillin sterile" empyema is applicable.

During the winter and spring of 1945 an epidemic of virulent respiratory infection occurred at a large United States naval training center where we were stationed. Many young Navy recruits were hospitalized for pneumonia and treated almost without exception with penicillin. The therapeutic results were amazingly good, and it was the general impression of the medical officers in attendance that penicillin prevented the tragedies of streptococcus pneumonia observed in the cantonments of World War I.

Unfortunately, accurate statistical information concerning those pneumonia cases is not available, but the following data have been furnished by the Chief of the Medical Service of the naval hospital where they were hospitalized. The mortality rate was under 1 per cent, the organisms most commonly encountered in sputum cultures were nonhemolytic streptococci, though pneumococci were predominant in some. One in every four of those pneumonia patients developed clinical and x-ray evidence of significant pleural effusion.

The usual treatment the pneumonia patients received comprised intramuscular penicillin and such supportive measures as were deemed necessary. Penicillin treatment was started on the basis of clinical findings and was usually begun very early in the course of the disease. When evidence of fluid in the pleural cavity developed, the chest was aspirated by needle and penicillin instilled into the pleural space, usually to the amount of 50,000 Oxford units. The pneumonias as such responded rapidly, but repeated aspirations and prolonged hospitalization were often required before the effusions subsided.

In this discussion we are concerned with the small group of five

pneumonia patients whose pleural effusions were not cured by penicillin and thoracentesis. At the time each of these patients came to surgery, the striking and misleading fact was that the man was not symptomatically ill. All of them had long since recovered from their pneumonia and were afebrile, comfortable, and ambulatory. Their nutrition and vigor were good and they were able to engage in relatively normal activity without dyspnea or undue pulse acceleration. In contrast to the usual empyema patient requiring surgery, they did not present the classical debilitated picture of chronic pleural infection. Their disability was of a mechanical nature. Large amounts of purulent fluid continued to accumulate in their chests even after repeated aspirations. Though purulent, the fluid was persistently sterile on culture. All patients showed progressive deformity of the chest, characterized by chest contraction, scoliosis, and respiratory lag.

Attempts were made in all these cases to exclude the possibility of tuberculosis. In all instances, smears and cultures failed to show acid-fast bacilli. Pleural biopsies taken at operation showed no evidence of tuberculosis.

CASE REPORTS

Case 1.—An 18-year-old apprentice seaman was admitted 3 January 1945, complaining of pain in the right chest and dyspnea. He had had a cold for 1 week. Physical examination revealed a critically ill, small, young, white male with rapid, shallow, grunting respirations. T.: 104° F., P.: 130, R.: 48. There were signs of consolidation at the right base. WBC.: 25,000. The urine contained albumin. The predominating organism in the sputum culture was *Streptococcus salivarius* (*streptococcus viridans*). He was placed in an oxygen tent and started on sulfadiazine medication. Twenty-four hours later the medication was changed to intramuscular penicillin. He improved rapidly but continued to run a septic temperature.

Two weeks after admission, right thoracentesis yielded 1,000 cc. of thin, cloudy fluid which had a WBC. of 28,000 but yielded no growth on culture and showed no organisms on smear. Fifty thousand units of penicillin were instilled into the pleural space. A week later, another thoracentesis yielded 600 cc. of cloudier fluid with a WBC. of 71,000, which was again sterile. One month after admission, the patient's temperature had returned to normal. He had received a total of 1,640,000 units of penicillin intramuscularly. He remained afebrile and began to gain weight, but fluid persisted in the right pleural cavity and he began to show a contraction deformity of the right chest and scoliosis. On 11 May 1945 and 21 May 1945 further thoracenteses were performed and small amounts of thick, greyish-yellow fluid removed. Cultures again showed no growth.

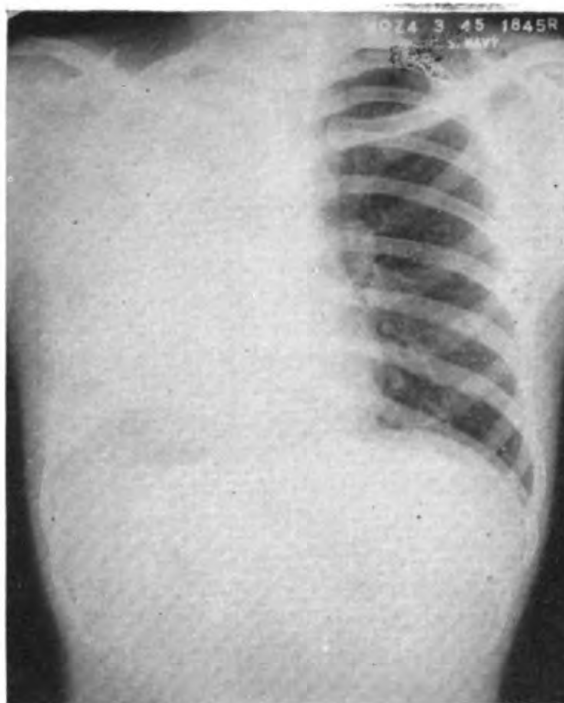
On 24 May 1945, nearly 5 months after onset of symptoms, thoracostomy was performed and segments of the right ninth and tenth ribs removed in the posterior axillary line. A large, single empyema cavity was entered. The parietal and visceral pleurae were greatly indurated and thickened, measuring approximately 2 cm. The cavity was partially filled with large, yellow, gelatinous masses of fibrin and debris. The fluid was sterile on culture. Open drainage was established and the cavity irrigated frequently with hypertonic saline solution. Postoperative convalescence was uneventful. The cavity diminished rapidly in size. The drain-

age tube was removed 1 month after operation and the wound healed within the ensuing 2 weeks. Chest deformity seemed to increase as the cavity became obliterated and it was felt that the mechanism of healing was not as much re-expansion of the lung as a contraction of his very pliable chest wall. He remained well and showed some slight increase in vital capacity. The chest deformity lessened during the ensuing few months, but nevertheless occasioned his discharge from the service.

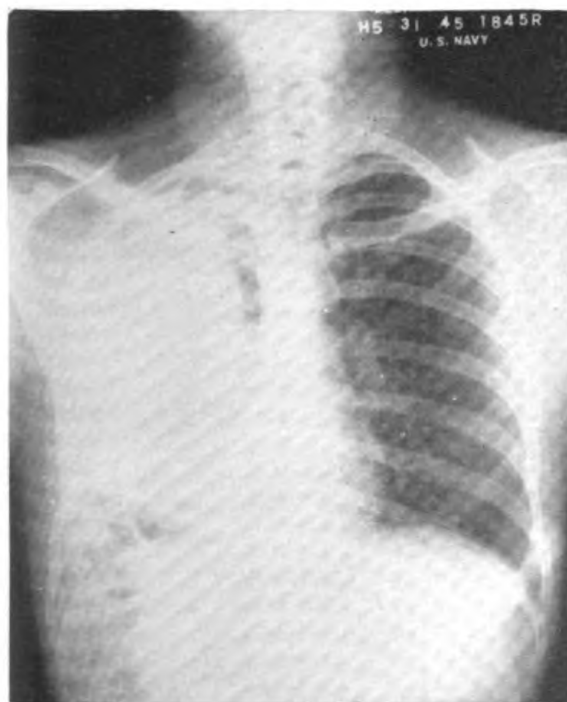
Case 2.—An 18-year-old seaman, second class, was admitted on 16 February 1945 complaining of pain in the left chest of 24 hours' duration. Physical examination revealed a moderately ill, young, white male, breathing rapidly and shallowly. T.: 101° F., P.: 100, R.: 40. There was dullness at the base

of the left chest. Chest x-ray revealed fluid at the left base and pleural thickening in the left base and axilla. WBC.: 20,000. Sputum culture yielded pneumococci and staphylococci as the predominating organisms with occasional colonies of hemolytic streptococci. Intramuscular penicillin therapy was begun. On 22 February 1945 a left thoracentesis

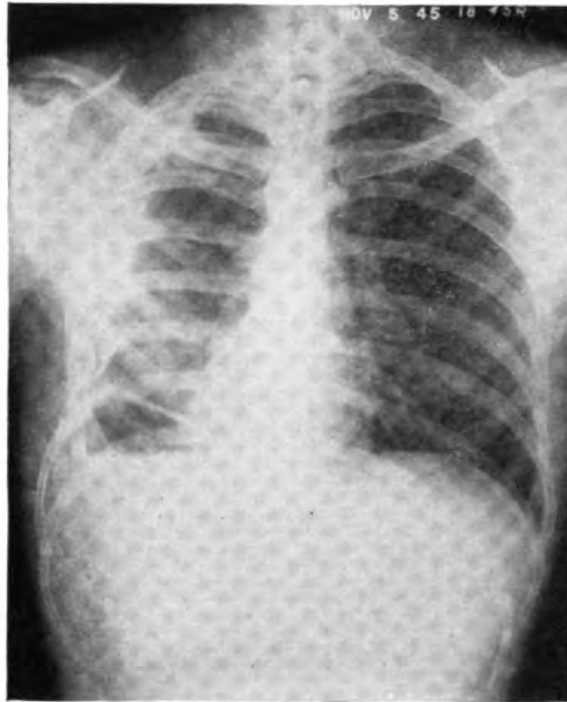
yielded 800 cc. of thin, straw-colored fluid with a WBC. of 3,600, and sterile on culture. Fifty thousand units of penicillin were instilled into the pleural space at the termination of aspiration. The man continued to run a fluctuating elevation of temperature. On 6 March 1945 another thoracentesis yielded 110 cc. of cloudy, straw-colored fluid, with a WBC. 7,000, which again yielded no growth on culture. Penicillin was discontinued after 2,540,000 units had been administered parenterally. After 3 weeks' hospitalization, the patient became afebrile, ambulatory, and began to gain weight. Signs of fluid persisted in the left chest and x-ray films indicated encapsulated fluid. In late May and early June 1945, further chest taps yielded small amounts of



1. Case 2, figure 1.



2. Case 2, figure 2.



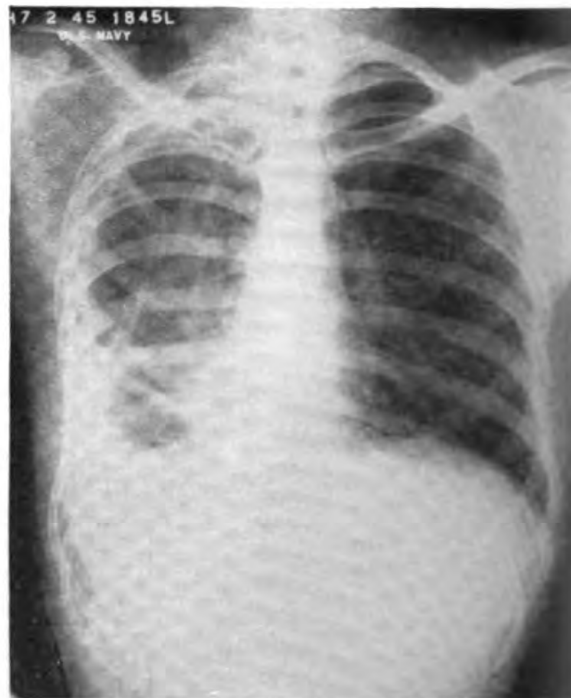
3. Case 2, figure 3.

in size. Re-expansion of the lung was so slow, however, that for a while decortication or thoracoplasty were seriously considered. Four months after operation the cavity contained only a few cubic centimeters of fluid and the tube was removed. Ten days later, 25 cc. of thin, sanguineous fluid was removed by thoracentesis. That fluid was also sterile on culture. Thereafter, no further fluid developed and the chest wound healed. Chest x-rays showed marked persisting thickening of the lateral pleura after the cavity had closed. The patient had meanwhile developed considerable flattening of his chest and some scoliosis, but those changes improved with a regime of graduated exercises.

Case 3.—An 18-year-old apprentice seaman was admitted 3 March 1945 complaining of pain in the right chest and shortness of breath. Symptoms were of 24 hours' duration. Examination revealed a critically ill, young, white male, breathing rapidly and shallowly. T.: 104° F., P.: 130, R.: 36. There was dullness at the base of the left chest where râles were also heard. WBC. 21,000. Moderate albuminuria. Sputum culture showed

thicker yellow fluid which was still sterile on culture.

On 12 June 1945, 4 months after admission, thoracostomy was performed under cyclopropane anesthesia, removing a segment of the left ninth rib in the posterior axillary line. A large empyema cavity extending over the posterior aspect of the lung was entered. The pleura was tremendously indurated and thickened, measuring 2 cm. The cavity contained large, yellow, flocculent masses of coagulated exudate. Open drainage was established. One week after operation, the cavity became secondarily infected. For several days the man ran a fever which was promptly controlled with intramuscular penicillin. The cavity was irrigated daily with hypertonic saline solution and gradually diminished



4. Case 2, figure 4.

streptococcus salivarius (*streptococcus viridans*) as the predominating organism. The patient was placed in an oxygen tent and intramuscular penicillin was begun immediately. Chest x-rays showed an early pneumonia at the left base and small pleural effusions at both bases. Blood culture taken at admission showed no growth. Signs of fluid increased at the left base and 2 days after admission left thoracentesis yielded 1300 cc. of cloudy, straw-colored fluid with a WBC. of 3,000. The fluid was sterile on culture. Fifty thousand units of penicillin were instilled into the pleura at the time of the tap. The patient responded well to treatment and his fever began to subside by lysis. Intramuscular penicillin was discontinued 12 days after admission, a total of 1,660,000 units having been administered. Temperature returned to normal after about 3 weeks and the patient became comfortable, ambulatory, and began to gain weight. Signs of fluid persisted in his left chest, however, and numerous thoracenteses were performed during his first month of hospitalization as follows: 8 March 1945, 1600 cc.; 10 March 1945, 730 cc.; 14 March 1945, 1520 cc.; 20 March 1945, 1500 cc.; 28 March 1945, 875 cc.; 5 April 1945, 375 cc.; 11 April 1945, 900 cc. Chest films showed the fluid becoming encapsulated and extending into the interlobar fissure. Subsequent taps were performed on 14 May 1945 and 22 May 1945 yielding 150 cc. and 700 cc. On successive taps, the fluid was observed to be thickening with a rising cell count which reached 75,000. On all occasions the fluid was sterile on culture, and no organisms were found on smear. Increasing deformity of the left chest, characterized by contraction and scoliosis developed during the 2½ months after admission.

On 28 May 1945, 3 months after admission, thoracostomy was performed. The man was in good condition and gaining weight. Segments of the left ninth and tenth ribs were resected in the posterior axillary line, opening an elongated tunnel-like cavity extending over the posterior lung and into the interlobar fissure. Both the visceral and parietal pleurae were ligneous and greatly thickened, measuring about 2 cm., and the cavity contained large, soft, yellow fibrin masses. Open drainage was established. The cavity was irrigated frequently with hypertonic saline solution and began to diminish in size. Obliteration of the cavity was slow, however, and the drainage tube was not removed until 3½ months after operation and 6 months after hospital admission. The wound healed cleanly 2 weeks after the tube was removed. The man's general postoperative course was uneventful. On a regime of graduated physical exercise, his chest deformity began to be less obvious and in November 1945, 8 months after admission, x-ray examination showed nearly normal lung fields.

Case 4.—A 21-year-old apprentice seaman was admitted 31 March 1945 complaining of pain in the left chest of 24 hours' duration. Physical examination revealed a moderately ill, young, white male, breathing rapidly and shallowly. The pharynx was inflamed. There were râles and dullness at the base of the left lung. T.: 102° F.; P.: 100, R.: 32. Intramuscular penicillin therapy was started at once. Signs of fluid developed and on 3 April 1945 a left thoracentesis yielded 1,000 cc. of thin, cloudy, greenish-yellow fluid which contained small flecks of white exudate.

On smear, the fluid showed many polymorphonuclear cells and occasional gram-positive diplococci but was sterile on culture. Twenty-five thousand units of penicillin were instilled into the pleural space. The patient made a good response to treatment and his fever subsided by lysis during the first 3 weeks in the hospital. He received a total of 3,100,000 units of penicillin intramuscularly. Fluid continued to reaccumulate in the left chest, however, obscuring the entire lung field in some x-ray photographs. Contraction and flattening of the chest gradually developed. Frequent thoracenteses were performed and progressively

thicker fluid was removed, which was persistently sterile. Penicillin was instilled into the pleural space after each of the taps, which latter yielded the following amounts of fluid: 6 April 1945, 1300 cc.; 9 April 1945, 350 cc.; 14 April 1945, 900 cc.; 19 April 1945, 900 cc.; 10 May 1945, 600 cc.; 5 June 1945, 100 cc. During that entire period of 2 months, the man's general condition was good. He became ambulatory and comfortable, gaining weight, and going on liberty.

Thoracostomy was performed 3 months after admission, on 6 Jun 1945, under cyclopropane anesthesia, resecting a segment of the left ninth rib in the posterior axillary line. A large cavity over the posterior part of the lung was opened and found to contain large fibrinous masses. The pleura was extremely dense and measured about 2 cm. in thickness. Open drainage was established and the cavity irrigated frequently with hypertonic saline solution. About 1 week after operation, the cavity became secondarily infected and the patient had a febrile episode of about 1 week's duration. After a brief course of penicillin, he developed transient urticaria and angioneurotic edema but became afebrile. The cavity began to close gradually. Three months after operation, the drainage tube was removed, the cavity became obliterated, and the chest wound healed. During the ensuing 2 months, the pleural thickening resolved somewhat, as judged by x-rays, and the contraction of the left chest became less obvious.

Case 5.—An 18-year-old apprentice seaman was admitted on 5 April 1945, complaining of pain in his right chest of 24 hours' duration and mild diarrhea for 48 hours. Examination revealed a moderately ill, young, white male breathing shallowly. T.: 101° F., P.: 110, R.: 30. At the base of the right chest, breath sounds were harsh and occasional râles were heard. Intramuscular penicillin therapy was begun upon admission. He continued to have fever and signs of further consolidation developed at the right base. On 9 April 1945, x-rays showed pneumonia and a pleural effusion on the right. In 12 April 1945, thoracentesis yielded 370 cc. of clear, lemon-colored fluid with a WBC. of 3,600. The fluid was sterile on culture and smears showed pus cells but no organisms. Penicillin was instilled into the pleural space. The man's fever subsided during the first 3½ weeks of hospitalization and penicillin was discontinued 12 days after onset, having totaled 2,360,000 units. On 25 April 1945, thoracentesis yielded 40 cc. of cloudy, yellow fluid with a WBC. of 22,000, but was again sterile on culture. Signs of fluid persisted at the right base, and on 11 May 1945, although the man was ambulatory and comfortable, chest x-ray photographs showed encapsulated fluid. The patient continued afebrile, vigorous, and gaining weight, although some contraction of the right chest was developing. Subsequent thoracenteses were performed as follows: 4 June 1945, 250 cc.; 14 June 1945, 140 cc.; 2 July 1945, 180 cc.; 19 July 1945, 200 cc.; 6 September 1945, 50 cc. The fluid obtained from these various taps became progressively thicker, more chocolate-colored, and on all occasions was sterile on culture. The pleura was noted to be thicker and was increasingly difficult to pierce.

Thoracostomy was performed on 11 September 1945. 4 months after onset, resecting segments of the eighth and ninth right ribs in the posterior axillary line. A large tunnel-like cavity which extended over the lateral chest wall was entered. The pleura was greatly thickened and indurated, measuring 2 cm. The cavity contained sterile, brown fluid and huge, soft masses of yellow fibrinous debris. Open drainage was established. During the first 10 days after operation, the cavity became secondarily infected and the man ran a fever up to 102° F., which subsided promptly on penicillin therapy. The cavity was irrigated frequently with hypertonic saline solution, its capacity began to diminish gradually, and the fixed lung began to reexpand. The man's general physical condition was excellent and there was further weight gain. On 18 November 1945, the cavity capacity was only 40 cc. and healing was complete a month thereafter.

DISCUSSION

Although these five patients represent only a small fraction of a large number of penicillin-treated pneumonias, their illnesses are believed to typify complications and resulting disabilities which will be encountered with increasing frequency as penicillin therapy for pneumonia is more generally adopted, unless the serious concomitants of an apparently benign course are more quickly recognized and promptly dealt with. Analysis reveals the following features common to all these patients:

(1) Although having originally only a thin, serous, pleural effusion, each of these patients went on to develop chronic suppurative pleurisy in spite of apparently successful penicillin therapy. The penicillin therapy was considered successful because it did overcome the pneumonia and, in addition, kept the pleural exudate free of demonstrable organisms. No more could be asked of an antibacterial agent than that it overcome the causative bacteria without causing damage to the patient. It is not felt that any characteristic of penicillin *per se*, in its parenteral or local use, played a direct role in the production of the chronic pleural changes which these patients developed. Penicillin therapy, however, undoubtedly played an indirect role in allowing those changes to become excessive, because the resulting sterility of the exudate and the patients' general well-being engendered a false sense of security and an unjustified hope for ultimate recovery under conservative treatment alone.

(2) The clinical course of these patients paralleled the favorable progress of their pneumonias but ran contrary to the unfavorable changes simultaneously taking place within their pleural cavities. As their pneumonia cleared, the patients' general condition improved, but even as their sepsis and fever subsided and their weight and strength improved, their pleural exudate became slowly more purulent, their pleurae thicker, and their lungs and chests constricted. Such findings, which are at variance with those usually observed in suppurative pleurisy not treated with antibiotics, suggest that the eventual pleural changes did not develop solely on the basis of infection but from some other cause, probably of a mechanical nature.

(3) The findings at operation were similar in all these patients and revealed why the repeated thoracenteses had long been therapeutically ineffective and often difficult to accomplish. There were large, single loculations of sterile, purulent fluid. In the fluid and also adherent to the pleural surfaces were large, curdy, flocculent masses and sheets of fibrin. Both the visceral

and parietal pleurae were tremendously thickened and indurated and resembled changes usually associated with long-standing chronic empyema.

(4) All these patients had unduly long periods of hospitalization. They were all on the sick list for over 6 months, although they had recovered from their febrile stage within the first month. The length of their convalescence was out of proportion to the severity and length of their infections.

(5) All of these patients developed some degree of chest deformity which should have been prevented, if possible, and which could probably have been avoided by a different course of treatment. Flattening and contraction of the involved hemithorax occurred with associated scoliosis. These patients were young and it was gratifying that after the empyema cavities had been obliterated, there was some apparent regression of the deformity and indication that further improvement might occur with the passing of time.

(6) All these patients responded favorably to the simple surgical procedure of rib resection and drainage. The pliability of their youthful chest walls very likely had much to do with such a favorable response. Considerable restraint was required to limit surgical treatment to such a simple procedure as thoracostomy. It may be that a "decortication" procedure should have been employed as developed by Burford et al.(2) for removing the thick, organizing fibrin membranes in early infected hemothoraces of war casualties. But, marked as their pleural thickening was, these few patients of ours demonstrated that their chest deformities were to some degree reversible, and in all cases the risks of decortication and the added deformity of thoracoplastic procedures were avoided.

In considering the history of these cases, it is apparent that some of them might have been treated more assiduously by more frequent, early thoracenteses or by closed intercostal drainage. Lack of more intensive, earlier treatment was due in part to the fact that these men were not clinically very sick and the case load of acutely ill patients per doctor placed great pressure on the medical staff. There were also the factors of uncertainty over what to expect in this new application of penicillin therapy and of hope that its success in some stubborn cases of postpneumonic effusions might be achieved in others. It was left too much to time to determine which patients would and which would not recover.

CONCLUSIONS

The main problems that such patients pose are how to prevent deformity and cut down the number of sick days. We believe the

solution to both is the same, namely, earlier open drainage of the infected pleural cavity by subperiosteal thoracostomy. As to the timing of such surgical intervention, we are in agreement with Poppe, (10) who has suggested trial of a 2 to 3 weeks period of penicillin therapy after onset of the pleural infection and resort to surgical drainage if empyema has not by then been prevented. If we had adopted such a practice of early surgical intervention, we undoubtedly would have operated on many more than those 5 men. Even though their exudates after 3 weeks of infection were still relatively thin, we believe that operation would have been well tolerated and morbidity greatly reduced. While the effectiveness of repeated thoracenteses and penicillin in healing many cases of suppurative pleurisy must be conceded, such measures and even closed drainage become futile if free masses of fibrin accumulate in the exudate, and become seriously detrimental if their protracted use allows time for the development of tremendous pleural thickening. In utilizing rib resection and open drainage, placement of the drainage site at the very bottom of the empyema cavity, adequately extensive removal of rib and incision of chest wall, avoidance of tight closure about drainage tubes, and painstaking aftercare of dressings are, of course, essential.

SUMMARY

Among approximately 1,000 pneumonia patients treated with penicillin in a United States naval hospital during the winter of 1944-45, 250 developed pleural effusions. Of the 250, only 5 ultimately required open thoracostomy for the relief of suppurative pleurisy. The predominating organisms were streptococci. A review of the clinical courses, operative findings, and postoperative convalescence of those 5 patients indicates the inadvisability of delaying surgical relief of suppurative pleurisy simply because the recurring exudate rapidly becomes sterile with penicillin therapy, remains sterile, and does not thicken quickly; or because the patient, meanwhile, resumes an appearance and a lack of symptoms closely simulating normal health. Open thoracostomy is suggested as the procedure of choice for shortening morbidity and preventing chest deformities in such patients, if penicillin and aspirations have not secured healing in 4 weeks.

REFERENCES

1. BLADES, B., HAMILTON, J. E., and DUGAN, D. J.: Observations on treatment of empyema thoracis with penicillin. *Surgery* 17: 572-589, April 1945.
2. BURFORD, T. H., PARKER, E. F., and SAMSON, P. C.: Early pulmonary decortication in treatment of post-traumatic empyema. *Ann. Surg.* 122: 163-190, August 1945.
3. BUTLER, E. C. B., PERRY, K. M. A., and VALENTINE, F. C. O.: Treatment of acute empyema with penicillin, *Brit. M. J.* 2: 171-175, August 5, 1944.

4. Penicillin Committee of the National Naval Medical Center (CRAIG, W. M., THOMPSON, G. J., HUTTER, A. M., BARKSDALE, E. E., PFEIFFER, C. C., and WOOLEY, P. V.): Penicillin; progress report, based on 1,455 cases treated at National Naval Medical Center, Bethesda, Maryland. U. S. Nav. Bull. 44: 453-479, March 1945.
5. D'ABREU, A. L., LITCHFIELD, J. W., and THOMSON, S.: Penicillin in treatment of war wounds of chest. Brit. J. Surg. (supp.) 32: 179-198, July 1944.
6. JACOBSON, J.: Penicillin in intrapleural infection. U. S. Nav. M. Bull. 46: 97-102, January 1946.
7. JOSEY, A. I., TRENIS, J. W., and KRAMMER, W. F.: Treatment of postpneumonic thoracic empyema with sulfonamides, penicillin, and repeated thoracenteses, Ann. Int. Med. 23: 800-815, November 1945.
8. METCALF, C. J.: Penicillin in treatment of streptococcal empyema. U. S. Nav. M. Bull. 45: 926-929, November 1945.
9. NICHOLSON, W. F., and STEVENSON, C. R.: Intrapleural penicillin in penetrating wounds of chest. Brit. J. Surg. (supp.) 32: 176-179, July 1944.
10. POPPE, J. K.: Limitations of penicillin in treating empyema, J. A. M. A. 129: 435-438, October 6, 1945.



A GROWTH FACTOR IN CERTAIN VEGETABLE JUICES

There is present in tomato and certain other vegetable juices an unidentified growth accessory substance. This "T" factor may act in conjunction with thiamine, but its heat-stable properties indicate that it is distinct from thiamine. The "T" factor was also found in liver, string beans, carrots, beets, onions, cabbage, peppers, spinach, and orange juice.—METCALF, D., HUCKER, G. J., and CARPENTER, D. C.: Growth factor in certain vegetable juices. J. Bact. 51: 381-384, March 1946.

TREATMENT OF IMPETIGO AT A TROPICAL BASE

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Dermatological cases formed 53 percent of the sick call at this station, situated in a tropical climate. Of these cases, 55 percent were pyodermic conditions. Most of these (47 percent) were impetigo, secondary to miliaria rubra or due to the combination of excessive perspiration plus uncleanness. The frequency of infections of the skin due to scratching prickly-heat is noted by Strong (1).

At this station, the majority of the personnel work directly under the tropical sun or in buildings which, though shaded, are still very warm. These consist of bakeries, galleys, warehouses, covered piers, and machine shops. Humidity is generally high. The air is usually dusty, making it impossible to keep the skin clean. Many of the duties require working with oils and greases. Bathing facilities, especially in the early days of construction of the base, were inadequate.

These conditions made it extremely easy to develop impetigo. It became imperative to form routines for the treatment of early and late cases of the disease.

Cases were labeled impetigo only if they fitted the definition of Andrews (2). The course of the disease varied little. Usually, purulent vesicles appeared, which on rupturing and drying, produced the typical honey-colored crusts. Successive crops of vesicles and bullae soon covered large areas of the body in many of the cases, producing coalescing lesions. In addition, the pruritus of the underlying miliaria caused scratching, helping to spread the infection.

Areas most commonly involved were the axillae, face, neck, buttocks, back, and chest. On the face and neck, the crusted lesions were more common, while in the axillae, the vesicles and bullae predominated.

Negro personnel did not develop impetigo to any great extent. Rare axillary vesicles were the only lesions noted.

At the suggestion of Lt. (jg) Robert L. Day (MC), U. S. N. R., the early lesions were treated as follows: New vesicles were broken with cotton applicators dipped in 10-percent silver nitrate solution. Next, either 5-percent ammoniated mercury or penicillin ointment

was applied. Crusts were always removed prior to the application of ointments.

It was found that greasy ointments were unsatisfactory in the hot climate. Water-soluble ointments were preferred.

Penicillin ointment was more effective when applied at least three times daily.

Nineteen cases had such widespread lesions that it was considered advisable to admit them to the ward.

These patients received 140,000 units of penicillin, given in 20,000-unit doses intramuscularly, every 3 hours. All new vesicles were ruptured with cotton applicators dipped in 10-percent silver nitrate solution. All crusts were removed daily. Penicillin ointment was applied locally three times a day.

From 24 to 36 hours after treatment was begun, all these cases but one showed complete cure. No new vesicles developed and all old lesions dried and vanished.

The patients returned to duty in 3 days, their clinical course shorter by from 3 to 10 days than the ambulatory cases.

One man required two courses of penicillin and was hospitalized 8 days. His lesions were primarily on the buttocks and thighs. It was thought he reinfected himself by breaking the vesicles while lying in bed.

Removal of the patients from their hot, dirty work environment to the comparatively cool and clean sickbay probably was a big factor in their rapid recoveries.

The penicillin ointment was prepared as follows.:

Rx	
Tragacanth.....	20
Glycerin.....	200
Water.....	200

The tragacanth was mixed with 30 cc. of glycerin and added to the remainder of the glycerin. To this 100 cc. of water were added and mixed. To the remainder of the water 100,000 units of penicillin were added and the whole thoroughly mixed.

REFERENCES

1. STRONG, R. P.: *Stitt's Diagnosis, Prevention and Treatment of Tropical Diseases*. 7th edition. The Blakiston Co., Philadelphia, 1944. Vol. 2, p. 1602.
2. ANDREWS, G. C.: *Diseases of the Skin for Practitioners and Students*. W. B. Saunders Co., Philadelphia, 1940.
3. DAY, R. L.: Personal communication.

PILOT-STALENESS

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Definition.—Pilot-staleness is a temporary loss of confidence, due to the emotional stress of depleting aviation experiences producing excessive stimulation of inherent and acquired characteristics of self-preservation, and giving rise to apprehension for security, with resulting conscious and subconscious establishment of emotional reactions, subjective and objective signs and symptoms, directed toward escape from danger. Pilot-staleness occurs in varying degrees at some time during the first 600 training hours in approximately 25 percent of pilots.

ETIOLOGY

Depleting aviation experiences are the exciting causes of pilot-staleness. The contributing cause is acute psychological inaptitude. The predisposing causes are chronic psychological inaptitude and chronic physical disability.

A. EXCITING CAUSES

The psychological stress of depleting aviation experiences are of five types: (a) General inability to maintain required flight standards; (b) repeated aviation accidents in quick succession; (c) repeated airsickness, black-out, or vertigo experiences; (d) adverse combat experiences; and (e) low squadron morale. All of these factors markedly aggravate the pilot's apprehension for personal security. Typical cases consistently present combinations of these exciting causes. At least four causes of low squadron morale are worthy of mention: (a) The inevitable "military" drifting in a haze of uncertainty; (b) the lack of knowledge on the part of the pilot that an aviator's work to be enjoyed must be alternated with healthy recreational activity; (c) the lack of the pilot's knowledge that a training base does not afford exhilaration from work, or pride in accomplishment, in proportion to the effort expended; and, finally, (d) repeated squadron fatalities.

B. CONTRIBUTING CAUSES

Contributing causes are those daily difficulties or frustrations which any individual meets in his adjustments to his environment, which in pilots rise to the significance of acute psychological inaptitudes. Of great importance are such factors as: (a) Bad news from home; (b) the loss of the girl friend back home to the local boy; (c) the unavoidable delays in training due to illness, with resulting detachment from established friends; (d) the early adjustments of married life.

C. PREDISPOSING CAUSES

Predisposing causes are those inherent deficiencies or adverse past experiences which any individual possesses, and which, in pilots, emerge to the significance of chronic psychological inaptitudes. Of importance are such factors as: (a) Lowered intellectual adjustment as evidenced by inadequate absorption of aviation ground training; (b) the tendency toward mental and emotional instability, with the common persistence of adolescent conduct patterns; (c) the inherent or acquired exaggeration of the characteristic of self-preservation; (d) marked introversion; (e) low initial motivation with the noteworthy lack of civilian vocation of the pilot prior to his entrance into aviation; (f) adverse environmental background; and, finally, (g) predisposing psychoneurotic heredity.

Chronic physical disabilities of borderline character, which the average individual satisfactorily tolerates, increase to significant proportion in pilots. Of importance are such disabilities as: (a) Abscessed teeth; (b) sinusitis; (c) borderline hypoendocrine abnormalities; (d) borderline hypotensive or hypertensive conditions; (e) borderline renal function; and, finally, (f) nearly any chronic disease which impairs physical stamina.

PSYCHO-PATHOLOGY

The early symptoms of pilot-staleness are the result of excessive stimulation of the sympathetic nervous system. The late symptoms and findings are essentially those of "body hypofunction." The latter appears to be due to a depletion of endocrine reserves and a neuroblocking of vasomotor impulses. While the seat of the trouble is apparently psychic in origin, the physiological cause and effect relationships are still a matter for speculation.

SYMPTOMS AND FINDINGS

The early subjective symptoms and objective findings of pilot staleness are very tangible with the common denominator of failing to

fall into a diagnostic pattern of any organic disease. The late subjective symptoms and objective findings are essentially of a vague character and usually void of diagnosis on a physical basis.

A. INCUBATION PERIOD

The incubation period of pilot-staleness varies from a few hours to several weeks. In pilots with normal psychological stability considerable aviation stress is required to produce this condition. In predisposed pilots, however, short bouts of a few hours to a few days may precede a sustained attack. Prodromal symptoms are usually mild and manifest themselves singly as a "headache" or "lack of pep" etc., for which the pilot seeks a couple of pills.

B. SUBJECTIVE SYMPTOMS

The subjective symptoms present a marked tendency to divide into early and late groups. While physical exhaustion is the most common symptom in the onset of pilot-staleness, it may not of necessity be the chief complaint as the condition progresses under a standard stress environment. Over a period of time, the mental mechanisms tend to convert the general symptom into one concerning a specific organ. One of the most common organs affected by this conversion mechanism is the ear. The pilot not uncommonly presents himself with the preconceived diagnosis of aerotitis media. On examination, no physical findings support the diagnosis. Additional questioning invariably discloses the true history of pilot-staleness. The following subjective symptoms are divided into early and late tendencies in order to bring some order to a host of apparently unrelated symptoms:

Subjective symptoms

Early tendency (increases vasomotor tension)	Late tendency (withdrawal symptoms)
Vague headaches. Anorexia. Diarrhea. Polyuria. Physical exhaustion: (a) during the day; (b) 10 to 12 hours' sleep on successive nights.	Vague disturbances of vision or hearing. Vague chest disturbances: left sided chest pain, palpitation, difficulty in breathing. Burning urination (high concentration and acidity). Constipation and distension. Vague extremity aches or sensations. Insomnia and restlessness. Lack of ability of length concentration. Reduced interest in the opposite sex. Immediate fainting history.

C. OBJECTIVE FINDINGS

The objective findings also present a marked tendency to divide into early and late groupings. Here, however, the multiplicity of mental mechanisms put to work in any specific pilot, and the variations in the combinations used in pilots as a group, produce a gigantic, though fascinating, test of a flight surgeon's imagination.

During the first few hundred hours' flying time (usually through operational training), the pilot overworks compensation, as evidenced by his "big talks." As the pilot assumes his responsibility on the ground as well as in the air, both sublimation and compensation, in a pilot of potentiality, serve him well. Unfortunately this becomes almost as confusing to the flight surgeon as it does to the commanding officer. Frequently on reclassification boards the flight instructor comments on the pilot's definite failure to maintain flight standards, while the commanding officer comments on his "excellent" officer-like qualities.

In aviation today, we have come to expect the pilot who has recently undergone a depleting aviation experience to temporarily "escape" through an increase in his use of alcohol, or by showing an increased interest in the opposite sex. Repression, the unconscious attempt to forget the stress, is the underlying mechanism in these manifestations. Usually the "escape" is of only temporary satisfaction and other mechanisms come into play.

Rationalization and suppression are common but not too effective mechanisms in pilots. It is rare to find a pilot who will admit to his flight surgeon, or even to himself, that he is "scared to death" a few days following a depleting aviation experience. His pride, or censorship, deny him the right to display fear, thus substitutions are sought. Usually rationalization and suppression leave the pilot with ideas that: (a) The specific type plane he is flying is dangerous; (b) that 110-octane gasoline is a dangerous gasoline to use; and (c) that a certain field or runway is dangerous, etc. If for any reason, the stress is increased, rationalization and suppression fail to be of any satisfaction and other less acceptable mechanisms are promptly utilized.

Nearly all of the late objective findings belong to unacceptable mechanisms of conversion, projection, and regression. Early tendencies of irritability, an anxious preoccupation, and nonconformity often precede the withdrawal symptoms.

The following objective findings are divided into early and late tendencies in order to bring some order to a host of apparently unrelated findings:

Objective findings

Early tendency (increased vasomotor tension)	Late tendency (withdrawal findings)
<p>Tenseness, tremor. Increased startle response. Increased use of alcohol and tobacco. Increased interest in the opposite sex. Irritability, fault finding, overly critical. Worried and anxious: (a) Verbally, (b) in appearance. Recent preoccupation and absent mindedness. Non-conformity as evidenced by: Failure to attend mess, missed flights, absence without leave, "flat-hatting" escapades, etc.</p>	<p>Decreased startle response. Confusion, depression, fearfulness. Resentfulness against others. Lack of interest, drive, attention, and memory. Decreased personal cleanliness. Social withdrawal, butt for jokes of other pilots, or considered "nuts." Recent facial or lid spasms. Recent stuttering. Extra-systole.</p>

Typical case No. 1 (with exciting cause only).—A pilot was admitted to the United States Naval Dispensary for medical observation (staleness) following a no-damage "wing-tip" mid-air collision 4 days previously which he admitted "scared him to death."

He had had no previous crashes, had an average flight training record, and successfully passed the biographical survey. He presented no history of upper respiratory infections or other pertinent past history.

He complained of: (a) Diarrhea, six to eight times per 24 hours, (b) vague headaches, (c) tremor, and (d) physical exhaustion, all initiating immediately following the near accident. The symptoms had persisted despite 12 hours' sleep during 4 successive nights.

Food and alcohol were ruled out as causes of the diarrhea. Physical examination revealed a blood pressure of 158/80 and a mild generalized lymphadenopathy.

The blood sugar, sedimentation rate, stool, Kahn, basal metabolism rate, complete blood count, electrocardiograph, chest, heart, and dental x-ray findings were all negative. The urine was highly concentrated with a Mosenthal of 1.016-1.028 and volume of 915 cc. The nonprotein nitrogen (39.2 mg%) and eye grounds were normal.

Following 8 days' hospitalization, all positive signs and symptoms returned to normal. The discharge blood pressure was 130/72. The pilot returned immediately to flight and completed the syllabus in a commendable manner without further signs or symptoms of pilot staleness.

Typical case No. 2 (with exciting and contributing cause).—A pilot was admitted to the United States Naval Dispensary for medical observation (staleness) at the request of his commanding officer for "doping-off" in the air and on the ground, during the previous 3-week period.

He had 300 hours in civilian light planes prior to his acceptance of a commission. He had one previous landing accident in his refresher course. He successfully passed the biographical survey. He presented no history of gastric disorder or pertinent past history.

He complained of: (a) 15 pounds loss of weight, (b) palpitation, (c) epigastric tenderness, (d) abdominal cramps, (e) constipation, (f) lack of ability of lengthy concentration, and (g) reduced interest in his marital relations.

He presented a marked concern over the loss of his dog, 1 month prior to admission. However, most of the symptoms and findings were initiated 3 weeks

prior to admission when his wife supposedly had been "attacked." He was confused and depressed and the butt for jokes of other pilots.

The only positive physical finding was a slight generalized epigastric tenderness.

The blood sugar, complete blood count, electrocardiograph, sedimentation rate, Kahn, urine, Mosenthal, agglutination for *B. abortus*, heart, chest, and dental x-ray findings were all negative. The basal metabolism rates were -14 and -7 at 3 days' interval. The gastro-intestinal series revealed a hypertonic and hyperperistaltic stomach associated with a spastic colon.

Following 9 days' hospitalization, all physical signs and complaints had returned to normal.

Total insight by the pilot into his difficulties was never completely attained, due perhaps to his justified feeling of inferiority as a "fair-weather" pilot in a high-caliber transport squadron.

The pilot was subsequently grounded for 6 months, pending reclassification.

Typical case No. 3 (with exciting and predisposing cause).—A pilot was admitted to the United States Naval Dispensary for medical observation (staleness), following a major-damage motor-failure forced landing 6 days previously. He sustained no injury.

His flight-training record was below average. From the twenty-fourth to the thirty-sixth primary hops, he developed a "tenseness" and tendency to "over-control" which resulted in his third primary accident. He completed the first and second phases of intermediate doing poorly in formation work, and became considered a "dangerous pilot." In operational training he had great difficulty in landing, and expressed a desire for change of duty. In the field carrier-landing phase he "doped-off" and "nearly killed himself and another student." On the next hop his engine cut out on take-off. Symptoms of pilot-staleness promptly appeared.

Psychological examination revealed a biographical-survey score of 142 (normal 160 to 200), with the following predisposing causes:

Present problem.—"Lately I've been 'doping-off' and don't give a damn about anything. I first noticed this during intermediate training. I've had five accidents since I started flying. Then, the other night I came close to another plane in night formation, which was really dangerous. I've got to stop 'doping-off' but I don't know how. Lately I fall asleep in ground school classes and find I'm getting bored over this routine stuff."

Family history.—Was essentially negative.

Environmental history.—This 20-year-old pilot, was the oldest of five children. He was born and reared in the Chicago area in a relatively low economic scale. As a youngster he went around with a tough gang, and at 16 years of age was apprehended for shoplifting.

Intellectual adjustment.—He graduated from high school in 1941, in the lower one-third of a class of 400. Two years of mathematics were barely survived. English, history, and geometry were failed and dropped. Aviation ground-school grades were below average.

Mental and emotional stability.—Were essentially negative except for an exaggerated instinct for self-preservation.

Sociality.—He habitually avoided sports and social functions, and admitted a dislike for rules and the necessity to conform. His philosophy of life was shallow, not well organized, and dominated by the selfishness of self-preservation.

Impression.—This officer apparently presents inadequate drive and limited insight into his capabilities and limitations. His inherent instinct

of self-preservation is excessively high. His past compensations are in general acceptable. He presents a persistence of the adolescent type of immaturity, and nonconformity. His immediate major conflict is his flying inaptitude. His aviation prognosis is poor, despite his accumulation of 307 hours' time.

Opinion.—NOT aeronautically adapted for control of aircraft.

On admission to the United States Naval Dispensary he complained of: (a) Vague headaches, (b) physical exhaustion during the day, (c) forgetfulness, (d) palpitation, (e) burning urination, (f) insomnia and restlessness, (g) nervousness, and (h) loss of ability of concentration, all of about 10 days' duration. He was observed to present: (a) A fine tremor, (b) increased startle response, (c) increased smoking and drinking, (d) increased systolic pressure and pulse rate, (e) a worried and anxious appearance and verbosity, (f) aviation nonconformity as evidenced by missing of 2 flights within the past week, (g) lack of interest in aviation, and (h) butt for jokes of other pilots. Physical examination was negative except for a prone blood pressure of 140/88 associated with a pulse rate of 94. All laboratory studies were negative. Subsequently he was absent without leave two times despite warnings by the senior medical officer and ward medical officer. Following 7 days' hospitalization all abnormal subjective and objective signs and symptoms returned to normal.

A commanding officer's board was conducted for failure to maintain flight standards. A physical examination was completed with the recommendation "NOT aeronautically adapted for control of aircraft."

DIAGNOSIS

The diagnosis of pilot-staleness is made on pilots presenting a history of a recent depleting aviation experience and subsequently presenting a large variety of early and late subjective symptoms and objective findings which fail to fit into the diagnosis of an organic disease and which promptly diminish or disappear upon removal of the pilot from a stress environment. Physical and laboratory findings are essentially negative except when a concurrent physical disability is present.

DIFFERENTIAL DIAGNOSIS

Pilot-staleness is one of the most important conditions met in aviation medicine today. Unfortunately its manifestations are as protean as those of syphilis, tuberculosis, latent malaria, or undulant fever. Without the aid of exclusion laboratory studies, the direct diagnosis of pilot-staleness inevitably falls into the realm of supposition. The isolation of an associated physical disability invariably demands a difficult decision. Is the physical disability the cause of the pilot-staleness, or is it merely a contributing factor? This controversy can be largely eliminated if the diagnosis of pilot-staleness is restricted to pilots presenting a history of a recent depleting aviation experience, whether in training or in combat.

The differential diagnosis demands the establishment as a contributing factor, or the exclusion, of all chronic diseases.

Emphasis must be placed on the fact that neither a diagnosis of psychoneurosis nor operational fatigue are appropriate in 95 percent of these cases. The establishment of such a diagnosis does the pilot a grave injustice.

PROGNOSIS

If adequately directed by an interested flight surgeon, the well-balanced pilot develops an insight into the causes and prevention of his difficulties and thus survives to become a better "deep-running" pilot with nearly permanent immunity.

The psychologically-unbalanced pilot has a stormy course with frequent exacerbations in direct proportion to the subsequent stress applied. If allowed to reach combat, he eventually breaks down with combat fatigue.

If unacceptable mental mechanisms prevail, the stale pilot may be found in severe difficulties with his commanding officer with doubt cast upon his officer-like qualities and desirability for retention in the service. The psychological trauma from such experiences and resulting actions aggravate the condition and the course is frequently continued for 4 to 6 months without remission, despite the removal from the stress environment.

COMPLICATIONS

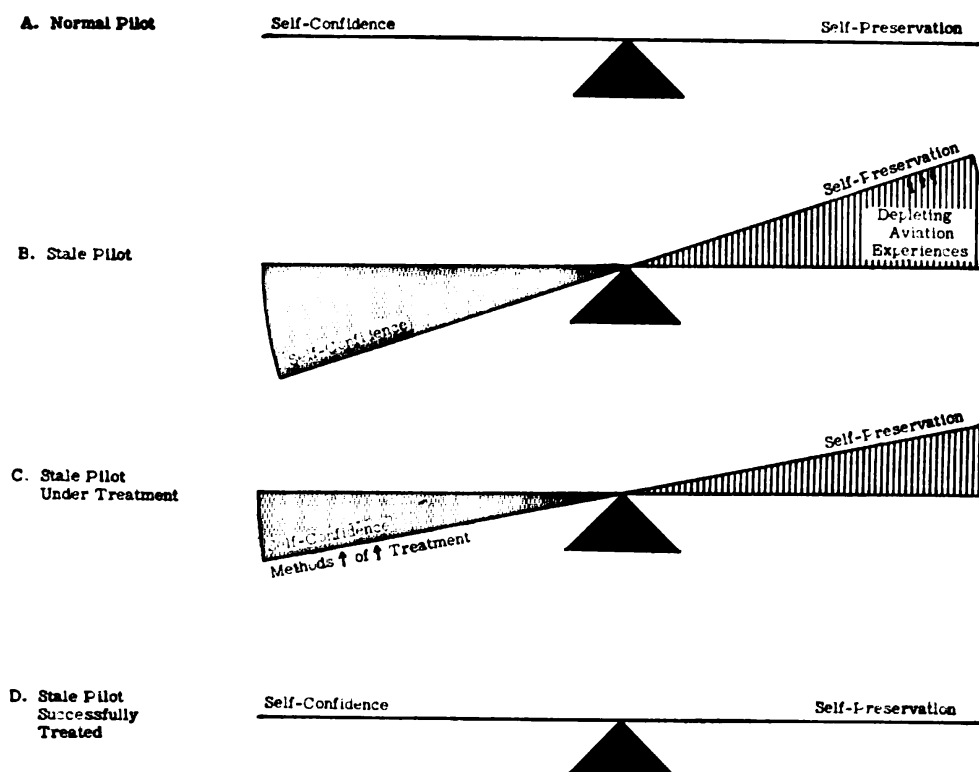
The complications are many and far reaching. The most common of these are: (a) "Blacking-out" and "doping-off" in the air; (b) non-conformity as evidenced by absence without leave, missed flights, "flat-hatting" escapades, or accidents; (c) commanding officer's investigation for failure to maintain required flight standards (these failures are essentially recent errors of judgment, concentration, and attention); (d) initiation of an alcoholic career and usually associated with girl trouble or marital difficulties where previous relations were smooth; and (e) eventual operational or combat fatigue.

It will be noted that many of these complications are identical with the causative factors of pilot-staleness. This serves to emphasize the vicious circle and down-hill course ahead of pilots of low potentialities in whom the mental mechanisms fail to offer a satisfactory adjustment and insight into their difficulty.

TREATMENT

The treatment of pilot-staleness is essentially one of prevention of loss of confidence, and the rebuilding of lost confidence. The importance of preventive and active treatment is emphasized by the fact that one out of every four pilots within the first 600 flying hours gives a history of pilot-staleness.

The following diagrams are offered for clarity.



Preventive.—The prevention of pilot-staleness may be divided into the following steps: (a) Improvement of standards of physical and psychological selection, through the use of laboratory diagnostic aids; (b) improvement and standardization of methods of elimination or reassignment of pilots failing to maintain required flight standards; (c) establishment of appropriate "rest" grounding for pilots subjected to depleting aviation experiences such as: (1) Repeated or frequent crashes in quick succession, (2) black-out or vertigo experiences, (3) observed loss of a friend in an aviation accident; (d) improvement of squadron morale by establishment of a reasonable military goal, with the assignment of a definite time latitude; (e) improvement of recreational facilities to occupy a pilot's leisure hours, with the utilization of aggressive and sustained leadership; (f) frank discussion of the lack of exhilaration from flying in proportion to the effort expended, as the cause of feelings of boredom and lack of progress of mind and body; (g) frank discussion of psychology of fear; (h) flight surgeons of sympathetic understanding, directing the stale pilot in gaining insight into his difficulty; (i) maintenance of standardized personal history records on all pilots to serve as a positive past history from which a firm stand can be taken concerning

disqualifying aeronautical adaptability; and (j) vocational rehabilitation for grounded pilots, with the establishment of a satisfactory replacement goal.

Active.—The active treatment can best be visualized if the problem is stripped to its simplest terms. On one side of a scale we have inherent and acquired characteristics of self-preservation over which we have little or no control. On the other side we have self-confidence, controlled by the individual's mental mechanisms. When self-preservation is high due to depleting aviation experiences, the pilot's self-confidence is proportionately lowered. As time passes, all but approximately 5 percent of pilots balance the scales by their own use of appropriate mental processes. However, only a small percent of pilots gain insight into the cause and effect relationships. Flight surgeons are capable of more quickly aiding this balance and insight, by the following measures: (a) Allowing the pilot to "talk himself out"; (b) common sense reasoning with the pilot; (c) persuasion by facts and figures; (d) breaking of the pilot's established adverse habits; and (e) offering appropriate suggestions.



ANTI-ANEMIC PROPERTIES OF THYMINE

Three patients with Addisonian pernicious anemia were selected, hospitalized, and given a diet devoid of meat and meat products. After baseline hematological studies were made and checked repeatedly, daily large doses of thymine were given orally.

The clinical and hematological improvement in these three patients was in every way similar to that which follows the administration of folic acid to patients with pernicious anemia in relapse. The exact mode of action of thymine is obscure, but it is possible that folic acid may act as an enzyme or co-enzyme in the synthesis of thymine or a thymine-like compound. Such synthesis may take place in the gastro-intestinal tract. The present findings indicate that thymine has antianemic properties and a profound effect on the general metabolism of patients with Addisonian pernicious anemia in relapse.—SPIES, T. D., FROMMEYER, W. B., JR., VILTER, C. F., and ENGLISH, A.: Antianemic properties of thymine. *J. Blood Hemat.* 1: 185-188, May 1946.

SURGICAL TECHNIQUE FOR FACIAL LACERATIONS

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Many unsightly scars can be prevented by the use of proper instruments and technique in the repair of lacerations about the face and neck. To every naval dispensary or sickbay constantly come men who have been injured about the face and neck by sharp instruments. The proper suturing of a nasal or cheek laceration at the time may prevent the plastic excision of an ugly scar at some later date. By adherence to a few rules, splendid results can be obtained in most all of such cases. First, use the finest needles and suture materials obtainable; second, recut ragged edges; third, use a subcuticular stitch; and fourth, take time.

The use of local infiltration anesthesia will usually distort the anatomy of the skin so that perfect suturing is made more difficult. It is, therefore, advisable to use regional block of nerves wherever possible.

A 6-0 nylon suture with a swaged-on needle is preferable, but where this is not obtainable, 4-0 or 3-0 sutures in any nonabsorbable material can be used. Size 50 cotton makes a good plastic suture. Fine half-circle eye or conjunctiva needles should be used. These are handled with a mosquito forceps or small needle holder. A small, fine, finger forceps can be used to pick up skin although skin hooks are preferable. The mouse-tooth and Russian forceps should never be used. Proper plastic skin hooks can be made from discarded dental instruments. The point or working end may be fashioned into a small C-shaped hook with a 2-millimeter throat. These are used to hold the skin instead of the usual forceps. They are placed below the surface of the laceration along the open edge so as not to pierce the skin surface.

Ragged edges of a laceration will not come together evenly and invariably a wide scar results. Ragged edges should always be recut to a smooth surface even though it means sacrificing more tissue and undermining in order to close the defect and relieve tension on the suture line. It should always be borne in mind, however, that when there is considerable loss of tissue from avulsion, as much tissue as possible always should be preserved. Skin hooks are advantageous in recutting the ragged edges. With an assistant holding the ends of the laceration taut with hooks, the operator can recut with a

third hook and scalpel. The scalpel preferred for this is the small, size 15 blade on a No. 3 handle.

With deep facial laceration, the skin can be beveled in so that when the lower edges are brought together with retention stitches, the tension is taken off the surface sutures. For retention suturing, a deep subcuticular stitch may be used, or interrupted stitches if a fine suture material is available.

For the surface subcuticular stitch it is important to remember that each stitch must be placed at the exact level of its neighbor in order that one skin edge does not close at a higher level than that opposite. In long lacerations the stitch should be brought from the inside out and then to the opposite side and into the laceration again about every 2 inches. This practice will facilitate its removal after healing. The ends of the stitch can be secured with a knot or not at all in small lacerations without tension.

If interrupted skin sutures are used, these should be placed close together and removed as early as possible. They should be $\frac{1}{8}$ to $\frac{3}{16}$ inches apart and often at least half of them can be removed the next day so as not to leave suture scars. The sutures can be studied and those with the most tension removed early. All sutures can be removed the third or fourth day where the tension is not great enough so that their removal will cause separation. Adhesive bridges may be used after removal of interrupted stitches.

In suturing the lacerated lip there is one rule that must always be adhered to. The vermilion border must be brought exactly together; "about" is not enough. Sutures should be removed and replaced until the result is perfect.

Due to abundant blood supply all wounds of the face bleed freely, but it is seldom necessary to ligate vessels unless they are spurting. Bleeding will usually cease with closure of the wound and numerous ligatures below the surface will only hinder the cosmetic repair. However, bleeding will interfere with the suturing and it is helpful to have an assistant keep the wound dry with a small sucking tube. These are easily made, and with the use of a length of rubber tubing and a proper connection can be attached to a water faucet for suction.

Most facial wounds, especially the smaller ones, do not require a dressing. They seldom become infected and it is usually difficult to keep a dressing on them. The patient should be instructed not to wash over the area.

A 3-inch facial laceration can be sutured carelessly within 2 minutes; however, if one takes 30 minutes the results obtained are well worth the extended effort. As a parting thought it is well to remember that it is better to take a stitch out and start over than to leave a facial wound that is not perfectly sutured.

NOTES ON BIOPSY

With Special Reference to Its Use and Misuse

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Accurate diagnosis and prompt selection of appropriate therapy of neoplastic diseases are essential if cancer mortality statistics are to be improved. Inasmuch as biopsy gives more certain results in the diagnosis of cancer than other available methods, this paper will be devoted essentially to notes on the use and misuse of biopsy, especially in regard to those types of tumors more commonly seen in the naval service. Emphasis will be placed upon the importance of biopsy in determination of diagnosis, therapy, and prognosis. Recognition of well-developed as well as incipient cancers in young men is not an uncommon experience. The only type of diagnostic management and therapy which should be undertaken in a given case should be the best possible. Conversely, if such facilities are not available, the patient with a suspected neoplasm should be transferred immediately without biopsy to a base where the complete study can be made and adequate therapy instituted.

The United States Naval Hospital, Oakland, Calif., has been the receiving hospital in varying degrees for the Pacific area. Not only have patients entered this hospital from base hospitals overseas but also from local dispensaries and smaller institutions. Out of the patients which have been admitted, there has been a surprisingly large group of neoplasms. In a number of these cases biopsy could have been more adequate and/or a more preferable therapeutic regimen selected.

The majority of physicians who first see patients with tumors determine their course and even their chance of survival. Of paramount importance is the correct handling of the patient who has a tumor. Unless the physician (with the proper equipment) can insure uninterrupted completion of the treatment, partial excision or biopsy should not be done. If a biopsy has been taken and it is necessary to send the patient for definitive treatment elsewhere, the tissue and/or histological slide should accompany the patient. It is suggested in such instances that the slide can be pasted inside the cover of the

health record (it will travel with surprising safety). When patients are transported long distances from advanced bases to the mainland, the accompanying data in the health record are frequently sketchy, and the original biopsy material becomes invaluable in determination of subsequent therapy. Unfortunately, in many instances the tissue or histological preparations do not accompany the patient. It then frequently becomes a matter either of waiting indeterminately for arrival of the biopsy or attempting to take another biopsy. In those cases which have received therapy en route, estimation of the patient's status may be difficult in the absence of the original material.

It is well recognized that not all pathologists are unanimous in their interpretation of various histological lesions. For this reason, too, it is desirable that slides accompany the patient so that the pathologist at the ultimate destination can arrive at his own conclusion and consult more intelligently with his professional colleagues (tumor board members). Ideally, all pertinent clinical facts in a given case should be briefly given to the pathologist before expecting him to give the best diagnostic and prognostic interpretation. *Too often there is a tendency to furnish the pathologist with no clinical background, or even the biopsy site.* Yet the pathologist is expected to give an expert interpretation.

TECHNIQUE AND HANDLING OF BIOPSY MATERIAL

Biopsy is performed to determine three main points: Diagnosis; degree of histological differentiation; and when possible, data as to the anatomical extent of a tumor. In view of this, adequate biopsy tissue should be carefully selected and properly handled. In order to preserve tissue structure as much as possible, care should be taken to avoid unnecessary squeezing of the tissue. When possible, a sharp knife should be used rather than scissors or cautery. This is especially true in the case of lymph nodes and cellular tissue with scant stroma where crushing of the tissue by squeezing may alter the cytology and structure to such a degree as to preclude diagnosis. Choice of fixative, early fixation, and proper staining are most important. Four-percent formaldehyde is possibly the most practical routine fixative although in cases where the tumor is apt to be unusual, it is advisable to fix thin slices of the tumor or bits of the biopsy in freshly prepared Zenker-acetic acid solution. The latter fixative should not be used if more than 24 hours are to elapse before the tissue is washed. Again, in reiteration, it is essential that the size of the biopsy be adequate for purposes of histological grading and it is to be remembered that in certain tumors the morphology may vary considerably, even within a small area. Variation in structure is notorious in many tumors such as those of the bone, skin, breast, and brain.

Methods of obtaining tissue for microscopical examination may be listed as follows: (a) Excisional (by scalpel, cautery, or radioknife); (2) incisional; (3) various punch methods; (4) curettage; (5) paracentesis, with examination of fluids (ascitic, pleural, etc.) for tumor cells; and (6) aspiration.

With these methods available there is no excuse for either attempting radical treatment or of abandoning a patient to a hopeless prognosis without the tissue proof. Generally, the probability of radical treatment which might be necessary in a given case should be anticipated whenever possible in advance of the biopsy, so that as little time as possible is lost between the time of the biopsy and the subsequent radical surgery or roentgen therapy. With many tumors, the length of this time interval is most important, making the dictum mandatory that the biopsy diagnosis be done by frozen section whenever possible, such as with tumors of the breast, thyroid gland, and bone. Too often we see instances where bone tumors have been biopsied days in advance of radical therapy. Biopsy of tumors of the skin, lip, bladder, and uterus is less dangerous; but even so a minimum of time should elapse before institution of treatment. Another dictum which cannot be emphasized too greatly is that *properly performed biopsy is less dangerous than is rough handling or massage of neoplastic tissue by patient or physician*. If fractionated courses of x-ray therapy are contemplated, biopsy may be taken after such treatment is well under way. The knowledge obtained from biopsy should always be correlated with the clinical stage or anatomical extent of the tumor. Specific instances and examples on the role of biopsy will be discussed in the paragraphs which follow.

Skin.—Not infrequently accurate diagnosis of neoplastic and so-called “pre-cancerous” lesions of the skin, as well as of some of the inflammatory diseases, can be made only by biopsy.

Clinically, the diagnosis of basal-cell as contrasted to squamous-cell carcinoma is possible in many but not all instances. Recognition of the mixed baso-squamous-cell carcinoma (none too rare) is possible only by microscopic study, and is desirable in charting the type of therapy and evaluating the prognosis. Biopsy is especially necessary, inasmuch as the squamous-cell component is capable of metastasis, whereas a basal-cell carcinoma seldom, if ever, metastasizes. Because skin cancers vary widely in their degree of histological differentiation, biopsy not only serves to establish diagnosis but gives valuable information in determining the type of treatment and even the dosage of irradiation. This is of paramount importance, especially in lesions which involve the eye lids and nose.

Melanotic lesions.—Incisional as well as incomplete biopsy should never be done on any lesion which is suspected of being a melanoma

or a melanosarcoma. Invariably, the lesion should be widely, deeply, and completely excised. As a general rule, electrodesiccation should never be done on a pigmented lesion. With a pigmented lesion, one is *never* able to predict accurately whether it is benign or malignant, whether it is "going to become malignant," or whether, with a little "irradiation," it might be rendered malignant. It is common practice to electrodesiccate unsightly pigmented lesions, but this procedure is unwise since the individual case may be the very one which should not be disturbed prior to excisional biopsy. While there are many pigmented lesions which subsequently have been proved to be benign, the loss of one case by mistreatment will justify a thousand precautionary "negative" excisional biopsies.

Cutaneous neurofibromas not uncommonly have been sources of error. Accentuated pigmentation in the basal layer of the immediately overlying epidermis is well recognized. Occasionally, such neurofibromas are clinically considered as melanotic lesions until proved otherwise by expert histological examination. Characteristically, most cutaneous neurofibromas are noncircumscribed, non-encapsulated, frequently cellular, and present a wide range of histological structure (pallisaded neurilemmoma as contrasted to reticulated neurilemmoma and myxoid neurilemblastoma). Incomplete excision of such lesions is not unusual. Too often inexpert histological examination leads to the diagnosis of sarcoma, thereby inflicting irreparable mental trauma on the patient, as well as leading to unnecessary radical surgery or roentgen therapy. Mixed neurofibromatous tumors containing nevoid and angiomatous components in varying proportions, as well as hemosiderin, are occasionally seen and may present perplexities to the histopathologist.

Lip.—The problem presented by a malignant lesion on the lip is of such consequence that an accurate diagnosis should be made at the first possible moment. Several methods of biopsy are available. In addition to the time-honored V excision biopsy, punch-type biopsy of the lesion (under irradiation) with a 5-millimeter punch is of considerable value. If the punch biopsy is "positive," destruction of the local lesion may be carried out as one thinks best, that is, by wide surgical excision or by irradiation. The latter has an advantage in that treatment may be started before the biopsy has been performed, and can be carried to a modest dosage before the diagnostic tissue report has been returned. Subsequent therapy may then be decided upon. In our experience punch biopsy while the primary lesion is under irradiation carries no additional hazard as regards the danger of metastasis. Further, irradiation for from 24 to 48 hours preceding biopsy does not interfere perceptibly with the histological study of the lesion.

The anatomical extent of carcinoma of the lip is of some consequence. If the neoplasm has invaded muscle, one must give serious consideration to a neck dissection. When the submental or cervical lymph nodes are palpable, it is mandatory that at least a suprahyoid dissection be done as soon as possible. Each node should then be sectioned and studied histologically. Not infrequently, such enlarged lymph nodes are found to be inflammatory, thus conferring a more favorable prognosis.

It is advisable in the naval service that cases of clinically diagnosed carcinoma of the lip be sent to the hospital nearest the patient's home for complete treatment and disposition. Initiation of treatment at overseas hospitals, unless postoperative disposition is to be carried out, is not advisable. Data in health records in such cases frequently are too sketchy, and it becomes impossible to ascertain the clinical status of the patient. He should receive his definitive treatment where he will be either observed or, if suitable for further service, sent back to duty.

Again, in reiteration, when biopsy is not performed, neoplastic lesions of the skin and lip are often diagnosed incorrectly. It is a person of limited experience, indeed, who has not often seen a supposed carcinoma of the lip turn out to be a variant of chancre, granuloma, or a benign papilloma.

Ear, nose, and throat.—Biopsy of some of these structures usually presents a more difficult technical problem than that encountered with cutaneous lesions. If the tumor is not readily accessible, biopsy should be performed only by one who is familiar with the more intricate anatomy of the part. Here only the earliest and most radical surgical procedure or irradiation (eyes, larynx) can offer a cure. A tumor of ever-increasing importance is lympho-epithelioma or carcinoma of the pharynx. Characteristically, the primary growth of this neoplasm is usually small, flat, infiltrative, and easy to escape detection except on repeated examination. Inasmuch as it permeates lymph channels early it frequently gives rise to enlarged regional lymph nodes long before the primary neoplasm becomes evident.

Cervical lymph nodes.—In the neck diagnosis of malignancy or inflammatory disease is often made by the simple expedient of excisional lymph-node biopsy. Members of the "lymphoblastoma" group frequently manifest themselves in the form of cervical lymphadenopathy. Occasionally, enlarged lymph nodes constitute the only manifestation of disease. Adequate, careful study of the excised node is essential to differentiate the type of lesion with which one is dealing. Occasionally, the stage of the disease process can be estimated and thereby a more accurate therapeutic regime and prognosis established. It is of importance, for example, to know whether the lesions of

Hodgkin's disease are early, moderately advanced or late; not only for prognostication but also for the amount of expected response from therapy.

Metastatic disease in lymph nodes of the neck presents the problems of identification and search for probable primary neoplasm. For the most part, two major groups of carcinomas are to be considered: (1) Adenocarcinoma, and (2) squamous-cell carcinoma. The former may be secondary to a tumor in the thyroid gland, the bronchus, or abdominal cavity; whereas common sites of origin for the latter are primary growths in the pharynx (lympho-epithelioma), skin, and less frequently in the bronchus and esophagus. Palliative treatment as well as attempted eradication varies widely with the site of origin. In this group of neoplasms, radiosensitivity of the lesion and prognosis may often be predicted from the biopsy.

The needle-biopsy method of procuring a fragment of tissue from enlarged cervical lymph nodes offers a chance for histological diagnosis when operation is risky or when the patient refuses operation. It is especially useful when neither a granulomatous lesion such as syphilis or tuberculosis nor neoplasm can be excluded. In several such cases which we have seen a dark-field examination of aspirated material established the diagnosis by revealing the presence of *Treponema pallida*. This is not the method of choice with malignant lesions but may well be of use in inflammatory lesions.

Lungs and pleura.—Early diagnosis of cancer of the lung is of increasing importance in view of the fact that surgical procedures in the removal of lung tumors have been improved and made less hazardous to patients. The bronchoscope has made possible earlier diagnosis by getting tissues to the pathologist rapidly, thus eliminating diagnostic uncertainty on the part of the surgeon. The same principles pertain here, applicable to degree of anatomical spread and regional lymph nodes, as in carcinoma of the breast. That is, in operable carcinomas of the lung, the regional lymph nodes should be removed *en masse* with the specimen in the same sense that one removes axillary lymph nodes in radical operations for mammary carcinoma. More explicitly, this means pneumonectomy rather than lobectomy for operable cases of carcinoma of the lung.

When bronchoscopic evidence is not available, thoracotomy may be done in selected cases for purposes of exploration and biopsy. If tissue diagnosis is obtained, a more radical procedure may then be carried out if deemed advisable. Frequently, this decision is impossible without histological proof.

If pleural fluid is present, a diagnosis may sometimes be made by studying the centrifuged sediment of aspirated fluid by the use of collodion sacs in centrifuge tubes. The sediment or "button" from

the centrifuged fluid enclosed in the ligated collodion sac is treated as a tissue, sent through the dehydrating fluids, embedded in paraffin, blocked, and sectioned for histological preparations.

Neurofibromas, bronchial adenomas, solitary tuberculomas, and other miscellaneous tumors occur often enough to make biopsy of pulmonary and intrathoracic tumors mandatory whenever technically feasible.

Genito-urinary tract (male).—Complete excision of a testicular tumor by orchidectomy is of such importance in treatment of cancer of the testicle that it is preferable to delay operation until facilities are available for frozen-section diagnosis. Then, if indicated, a radical dissection of the lymphatics may be carried out. Incisional biopsy of testicular masses followed by delay is never justifiable.

Recognition of the type of malignant testicular tumor is useful in evaluation of prognosis. Chorioma testis and embryonal adenocarcinoma tend to form small primary tumors with early blood stream invasion and an unpredictable vascular distribution of metastases, whereas seminomas (embryonal carcinoma with lymphoid stroma) tend to become larger and to spread at first by way of the lymphatics rather than the blood vessels. Prediction of the probable site of metastasis on the basis of histological type of the tumor is of great aid to the roentgenologist in selecting areas to be treated by irradiation.

The prostate is accessible transurethrally through the cystoscope, by perineal exposure, and less preferably through the bladder by suprapubic cystotomy. Diagnosis of prostatic malignancy may be suspected by the palpating finger but not diagnosed without biopsy. In men above 40 years of age the percentage of "occult" carcinoma rises sharply. Hence, all bits of tissue removed transurethrally for any purpose whatsoever should be examined microscopically. Thus earlier diagnosis may be made than would otherwise be possible.

Bone and connective tissue tumors.—The diagnosis of many bone tumors has been made with the use of x-ray studies alone, especially in the hands of experienced roentgenologists. However, even with the aid of x-ray studies, diagnosis is never certain. In the difficult cases, experts frequently disagree. Unfortunately, too, pathologists sometimes disagree amongst themselves and have difficulty arriving at the correct diagnosis. This is well exemplified by some of the giant-cell tumors and osteolytic-osteogenic sarcomas.

The surgeon who actually does the operating should be as certain as possible that the diagnosis is malignancy rather than inflammatory disease or a benign neoplasm before resorting to amputation of an extremity. Biopsy of the bone lesion, usually with a tourniquet proximal to the lesion, is mandatory. *In operable cases, no surgical*

procedure should be carried out on a suspected malignant lesion of bone or its coverings without the mental preparation and equipment to carry out the most radical procedure necessary for a complete eradication of the disease at that time. In this regard, it is most important that the possible need for radical surgery at the time of biopsy be talked over with the patient and that the necessary consent be obtained. Procrastination or deviation from this rigid regimen may well result in loss of the patient's life.

Breast.—The precepts of correct management in carcinoma of the breast are well known to everyone, but occasionally some operator "takes a chance." How often one sees local excision of a mass in the breast without either physical or mental preparation on the part of the operator for a radical procedure! The case is then either operated on again or, more usually, is sent elsewhere for a radical mastectomy. Responsibility for a poor result thus is usually attributed to the second operator, at least in the eyes of the patient's family or friends.

A word of warning should be said in regard to the "positive" axillary lymph-node biopsy in patients with no palpable breast tumor. The breast as a place of probable primary origin should always be suspected when a "positive" axillary biopsy is found, i. e., a lymph node containing metastatic ductal- or adeno-carcinoma. In such cases, it is not uncommon that the primary lesion is small and may be found only after diligent search. A procrastinating policy of "wait and see" only too often is fraught with tragedy.

Palpable enlarged axillary lymph nodes do not always connote metastatic carcinoma; they may well be inflammatory. Therefore, careful study by the pathologist of each axillary lymph node in the specimen is necessary not only for purposes of diagnosis but for determination of the anatomical extent of the disease. This is mandatory for purposes of possible further therapy and evaluation of the prognosis. For example, if no tumor is found in the regional lymph nodes, the carcinoma is classified as pathological stage I, and postoperative irradiation is not necessary. If, however, a tumor is found in any of the nodes, the case becomes a pathological stage II, and postoperative irradiation is then desirable.

Rectum.—A physical examination is not complete without at least digital examination of the rectum. Rectal examinations are omitted far too frequently. A majority of the rectal cancers seen at this hospital have been admitted with the complaint of anal bleeding and the diagnosis of "hemorrhoids"! In many of these cases, rectal examination by the original examiner would have aided in establishment of the correct diagnosis weeks or months earlier.

Hematopoietic tissues.—The diagnosis of blood dyscrasia, malign-

nancy, and "lymphoblastoma" may fail in the peripheral sites such as lymph nodes and peripheral blood. In some cases clinical observation may point to a primary bone-marrow disturbance so persistently as to make bone-marrow biopsy essential. It is the opinion of the authors that bone-marrow aspiration and smear is not sufficient but when possible should be supplemented by biopsy. The sternal bone marrow is easily accessible and is a favorite site of biopsy, although in women a flat bone such as the ilium may be used. This is one group of cases in which the group approach with consultation between the pathologist, radiologist, and internist is especially desirable.

SUMMARY

1. Biopsy is of paramount importance in the management of malignant diseases, not only for diagnosis but for prognosis and therapy.

2. It is necessary to have both the mental and physical preparations available in order to carry out the most radical procedure necessary for eradication of existing malignant disease.

3. The role of biopsy is discussed in relation to malignant and some nonmalignant diseases, especially as seen in the naval service.

4. Careful handling of adequate biopsy specimens is emphasized and methods for procuring biopsies are listed.



THE ENZYMES OF HEALING WOUNDS

Authors' summary.—1. The effect of different degrees of vitamin C deficiency has been studied on the rate of healing, phosphatase activity, and differentiation of the scar tissue in small open skin wounds in guinea pigs.

2. The rate of healing, epithelialization and contraction of the wound were greatly retarded in animals receiving respectively 0.5, 0.7, or 1.0 mg. ascorbic acid daily. Severe adhesions to the base of the wound in these groups were noted. At the 2-mg. level healing was more normal, and phosphatase activity, though subnormal, was increased.

3. The optimum level of vitamin C as assessed by its action on rate of healing, differentiation and phosphatase activity, is not less than 5 mg. of ascorbic acid a day, and possibly even higher.—DANIELLI, J. F., FELL, H. B., and KODICEK, E.: The enzymes of healing wounds; II: Effect of different degrees of vitamin C deficiency on phosphatase activity in experimental wounds in guinea pig. *Brit. J. Exper. Path.* 26: 367–376, December 1945.

EDITORIALS

PROGRESS TOWARD THE CONQUEST OF BLINDNESS

Much has been accomplished in the battle for the prevention and treatment of blindness. The first great advance was the discovery of smallpox vaccination at the end of the nineteenth century, for in the pre-vaccination era when smallpox was a universal disease, facial disfigurement and blindness, the two most common sequela, were seen everywhere. The prevention of injuries to the eye from industrial accidents by the wearing of protective goggles and the use of shielding devices on power grinding machinery has been another important measure in lessening the incidence of blindness. Progress in the treatment of diseases of the eye such as glaucoma, and of diseases like diabetes in which eye complications are characteristic, has further reduced blindness. It must not be forgotten that the use of lenses of various sorts has prevented the virtual blindness of severe astigmatism or presbyopia.

The development of Braille and similar methods of reading have been great advances in the mitigation of the condition of the blind. Research toward the conversion of a visual alphabet to an auditory alphabet, in which the Naval Medical Research Institute is participating with other agencies, may succeed in opening a still larger field of literature to the blind. So also are the methods of increasing the safety with which the blind can move about in the home or on the street, through the assistance of human, animal, or mechanical guides.

The Surgeon General of the Navy has recently suggested a new path of research which may further advance the treatment of blindness. He suggests that the light waves carrying visual perception be converted by electronic methods to correspond with the nerve wave lengths which stimulate the visual centers in the brain. By this method we could hope to by-pass the lost ocular apparatus and transmit the visual image thrown upon the retina in the normal eye, directly to the visual centers. This ingenious idea may at first seem somewhat visionary but when one remembers that Jules Verne's 80 days to go around the world has been reduced to less than 5 days, the idea proposed must be at least considered feasible. It would seem that the

use of our modern facilities for research would enable a serious attack to be made upon this problem, and that which may be only a dream at present might become a reality in the future and add one more victory leading towards man's final conquest of blindness.



POISON IVY IN THE NAVY IN 1879

In the June number of the UNITED STATES NAVAL MEDICAL BULLETIN, a timely article on poison oak and a scientific and medical note on poison ivy were published. Without any facetious intention it may be said that the subject is one of perennial interest. Each spring and summer the number of cases of poison-ivy dermatitis are numerous and almost Nation-wide. However, the leaves of the poison ivy change in the autumn to colors vying in attractiveness with the autumn foliage of the oak and maple. For this reason garlands of the leaves often are picked and carried home for decorating purposes with disastrous results.

It is, therefore, not inappropriate in the fall to mention this ubiquitous plant. It would seem also that difficulties with it were not unknown in the Navy nearly 75 years ago. This is shown by an extract which is here quoted from the Sanitary and Statistical Report of the Surgeon-General of the Navy for the Year 1879. It is of interest not only historically, but scientifically and clinically as well. The discussion of the plant, the symptoms of poisoning by it, susceptibility to it, and even the treatment are excellent and applicable today. The following is the description from the report of Surgeon G. W. Woods, U. S. N.:

"The poison oak *Quercus Viri* is also indigenous to Mare Island, and during the spring many cases of poisoning occur. When young, it is somewhat of a creeping plant with small red leaves resembling the oak, but when older it attains the height of 6 to 8 feet, appearing something like the dogwood of the Atlantic States, and bears a larger leaf resembling the maple. Its flower is very minute, and its fruit a small hard berry. The sanguineous and lymphatic are most susceptible to its influence, in whom it first produces an intense pruritus, followed by erysipelatous redness and oedema which affects the whole body, but especially the face, which becomes extremely swollen, and the eyes closed from puffiness of the lids. Those of a thin, spare habit may generally handle it with impunity, while with those whom it influences, it is not necessary that it should be touched, the volatile poison imparted to the atmosphere being sufficient to produce its worst effects.

"The symptoms being allied to erysipelas, the treatment for that cutaneous affection has generally been pursued, viz: tincture of iron internally, lead and anodyne lotions, soothing ointments, &c. A decoction of the *Grindelia hirsutula* and *Robusta*, the common "tar weed" of California, is undoubtedly curative, used both internally and externally. Aqua ammonia gives great relief, as does water as hot as can be borne; but all remedies must yield to bromine diluted with glycerin (M xx=f3) as a local remedy. It is in fact a specific and was first brought to the notice of the profession by Passed Assistant Surgeon S. A. Brown, U. S. N."



CASUALTIES FROM COMBAT AND DURING THE TRAINING PERIOD OF MILITARY FORCES

One feature in which this war differs from all previous wars is the greater employment of complex mechanical weapons of all sorts. There were many new and important types of ordnance and ammunition employed; airplanes and tanks were used on a great scale; and construction projects of vast proportions required the employment of tremendous amounts of machinery of all types. The operation of these weapons and equipment and the training in their use produced a great many casualties from accidental injury. Indeed, while all statistical evidence is not yet available, sufficient is at hand to indicate that the number of casualties in training operations in the building of bases and the deployment of forces was actually, in many theaters, greater than those sustained in combat. In the British Army in the Middle East there were 48.72 per thousand of accidental injuries. Battle casualties in the same area for 1942 were 31.1 and in 1943, 22.5.

Very striking are the percentages of eye injuries among soldiers in the United States Army reported as a preliminary study in the American Journal of Ophthalmology. In 399 wounds requiring excision of the eye between 7 December 1941 and 6 June 1944, only 56 were from wounds received in action while all others were received after D-day until the termination of hostilities. As this includes the severe fighting in Europe after the Normandy landing, it is likely that the proportion of battle wounds will rise very steeply.

As additional statistics are received it will be most interesting to observe the ratio between wounds received in combat and wounds received in training and deployment.

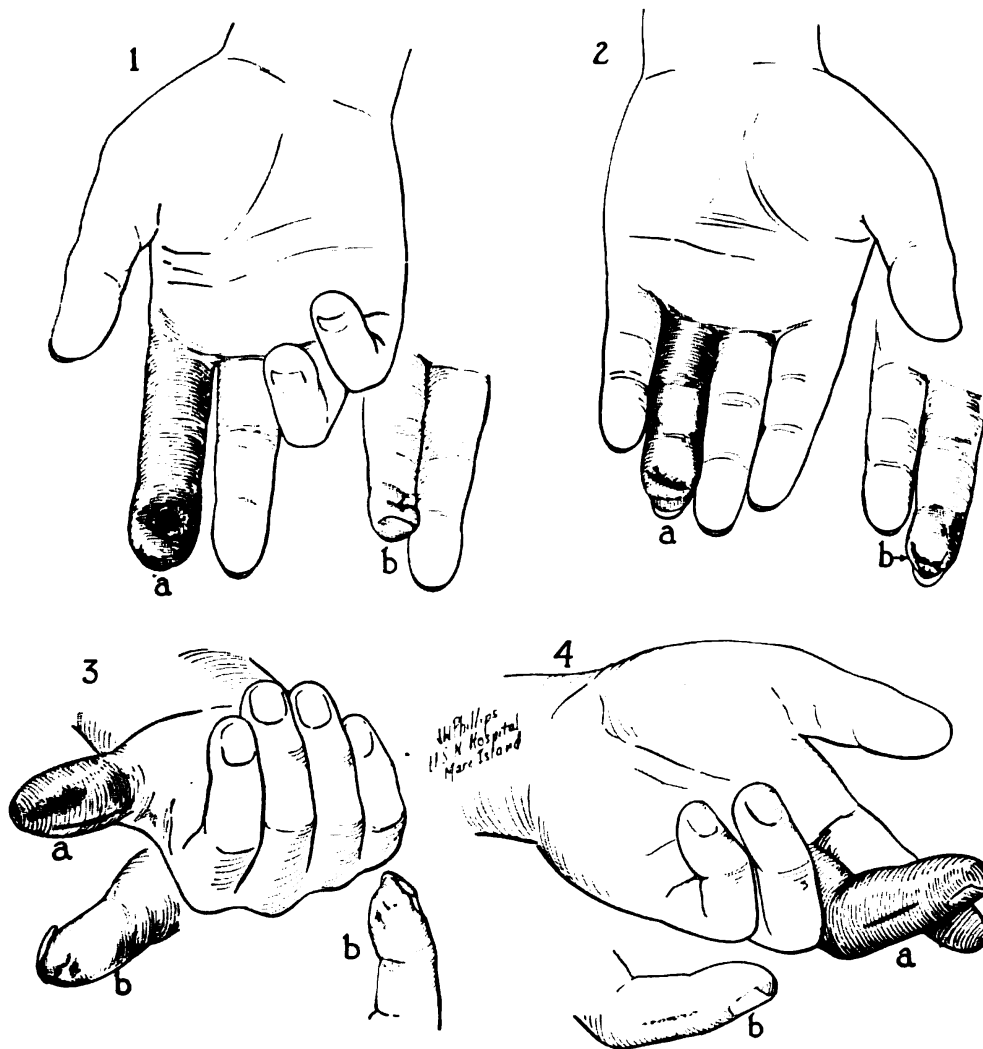


CLINICAL NOTES

BONE FELON¹

JOHN F. LOVEJOY
Commander (MC) U. S. N. R.

Drawings of four cases are presented to show the severe disabilities that may result from a relatively simple condition and to suggest a means of avoiding this disability.



¹ From the Orthopedic Service of the U. S. Naval Hospital, Mare Island, Calif.

Case 1.—(a) Appearance when first seen; (b) condition of finger when healed.

This felon was allowed to rupture under hot wet dressings. Under treatment for 4 weeks in dispensary and 12 weeks in hospital.

Case 2.—(a) Appearance when first seen; (b) condition of finger when healed.

This felon was opened by a hospital corpsman. Under treatment for 3 weeks in dispensary and 16 weeks in hospital.

Case 3.—(a) Appearance when first seen; (b) condition of finger when healed.

This felon was opened by a medical officer. Under treatment for 6 weeks in dispensary and 13 weeks in hospital.

Case 4.—(a) Appearance when first seen; (b) condition of finger when healed.

This felon was operated on in the acute stage at this hospital. Under treatment for 4 weeks in hospital.

A plea is made for the early diagnosis, and the lateral drainage of this condition. This will prevent a painful, disabling scar on the digital pad. A double lateral incision with through and through drainage is often indicated, and easily accomplished. The optimum time for drainage can be readily determined by careful daily observation. Even though there is a tendency for the abscess to point through the digital pad, this can be averted by a lateral incision. Chemotherapy is indicated pre- and post-operatively. The local use of pencillin has been found advantageous in the experience of the writer.



STEVENS AND JOHNSON'S DISEASE

REPORT OF A CASE

WILLIAM UMIKER

Commander (MC) U. S. N.

and

MICHAEL CROFOOT

Lieutenant Commander (MC) U. S. N. R.

A syndrome described by Stevens and Johnson (1) in 1922, consisting of conjunctivitis, stomatitis, and dermatitis, has been reported subsequently by numerous authors under various titles including

"ectodermosis erosiva pluriorificialis" (2), "dermatostomatitis" (3), "eruptive fever associated with stomatitis and ophthalmia" (1), and "atypical erythema exudativum multiforme" (4). In the reported cases no etiologic agent has been undisputedly established, but most investigators concur that the disease process is closely related to erythema multiforme, and specific factors such as Vincent's organisms (5) and phenolphthalein (6) have been incriminated.

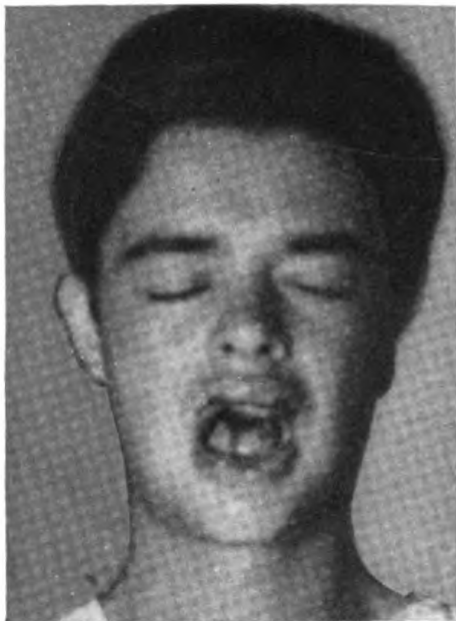
The malady, usually afflicting infants and young adult males, is characterized by abrupt onset with hyperpyrexia, conjunctivitis, stomatitis, and generalized skin eruption. Urethritis, balanitis, and rhinitis are not uncommon. The conjunctivitis may be severe and not infrequently results in panophthalmitis with permanent visual loss. A painful ulcerative stomatitis is often accompanied by pronounced dysphagia and dysarthria. The skin lesions usually consist of bullae or pustules superimposed on inflammatory nodules or plaques. The



1. Skin lesions of hands showing bullae superimposed on inflammatory nodules.



2. Skin lesions of hands showing bullae superimposed on inflammatory nodules.



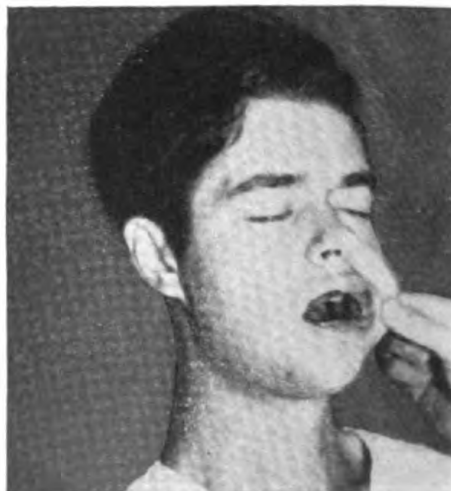
3. Severe ulcerative lesions of mouth and lips.

latter are usually associated with minimal pruritus or pain. The disease is self-limited, and no therapeutic measures to date have proved efficacious. Sequelae are rare and are limited to impaired vision secondary to the panophthalmitis.

Case report.—The patient, a 20-year-old seaman, was admitted to the sick list with the diagnosis, conjunctivitis, unclassified, because of intense itching and burning of the eyes unaccompanied by any discharge but with marked lacrimation and photophobia. Simultaneously a few vesicles of the oral mucosa and a nonpruritic skin eruption of the hands and feet were noted. Dietary indiscretion, drug ingestion, and all forms of allergy were denied by the patient. With orthodox therapeutic measures abetted by parenteral penicillin, the conjunctivitis improved,

but the mouth lesions rapidly worsened, and 9 days later he was transferred to a naval hospital.

Routine examination disclosed a dehydrated, acutely ill, white male in great discomfort with pronounced constitutional symptoms. Oral examination revealed intense congestion with spotty ulceration of the gums, palate, tongue, buccal mucosa, and lips. Some of the ulcerations were covered by a greyish pseudomembrane. All parts of the mouth were exquisitely tender and bled readily. Salivation was marked. The conjunctiva exhibited minimal residual injection. Over the dorsal and flexor surfaces of the hands, wrists, ankles, and feet were discrete bullous lesions superimposed on red nodules, creating an iris-like appearance. The bullae varied in size from 1 to 4 centimeters in diameter and were filled with thick, clear, yellow fluid which contained a few lymphocytes, scattered granulocytes, and rare eosinophiles. Culture of the aspirated contents yielded no bacterial growth. The urethral meatus was edematous and red while the shaft of the penis displayed a small bulla. No anal lesions were noted. Culture of the mouth lesions disclosed only scattered colonies of *staphylococcus aureus*. Blood cytology, chemistry, and serology, as well as urinalysis, were all within normal limits although the rate of erythrocyte sedimentation was persistently elevated.



4. Severe ulceration lesions of mouth and lips.

On the day following admission to the hospital, the patient developed a septic fever with a fastigium of 103° F. A regime of penicillin, 240,000 units daily, was augmented by mouth irrigations and rehydration with intravenous fluids. Parenteral fluids were obviated by the intense buccal lesions. Further supportive therapy included parenteral dextrose, protein hydrolysates, and blood plasma. A progressive beneficial effect was obtained, and 2 weeks after onset of illness, the mouth lesions had improved to such an extent that he tolerated fluids and soft food by mouth while the skin lesions had regressed, leaving deeply pigmented, brownish plaques at the sites of the bullae. Recovery was complete in 5 weeks.

A typical case of Stevens and Johnson's disease has been presented. No etiologic agent was found. Recovery was complete and possibly hastened by the use of penicillin and parenteral amino acids.

REFERENCES

1. STEVENS, A. M. and JOHNSON, F. C.: New eruptive fever associated with stomatitis and ophthalmia. *Am. J. Dis. Child.* **24**: 526-533, December 1922.
2. KLAUDER, J. V.: Ectodermosis erosiva pluriorificialis; its resemblance to the human form of foot and mouth disease and its relation to erythema exudativum multiforme. *Arch. Dermat. & Syph.* **36**: 1067-1077, November 1937.
3. LOW, E. B. and DAVIES, J. H. T.: Dermato-stomatitis (Baader); complicating case of manic-depressive insanity. *Brit. J. Dermat.* **50**: 141-150, March 1938.
4. GINANDES, G. J.: Eruptive fever with stomatitis and ophthalmia; atypical erythema exudativum multiforme (Stevens-Johnson). *Am. J. Dis. Child.* **49**: 1148-1160, May 1935.
5. CHICK, F. E. and WITZBERGER, C. M.: Erthema multiforme exudativum accompanying oral Vincent's infection. *Am. J. Dis. Child.* **55**: 573-578, March 1938.
6. SUTTON, R. L. and SUTTON, R. L. JR.: Diseases of the Skin. 10th edition C. V. Mosby Company, St. Louis, Mo., 1939. p. 146.



ORBITAL HEMORRHAGES FOLLOWING PRESSURE ON NECK

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Skylarking on deck has produced many types of injuries to personnel. This report will present an unusual and rare injury resulting from excessive neck constriction.

While wrestling on the deck of a destroyer, in pure fun, a sailor obtained a stranglehold upon the neck of his shipmate. The hold was such that the victim's neck was encased laterally and anteriorly

by the arm and forearm of the aggressor, who held the subject tight to his chest. Pressure on the neck was increased until the unfortunate subject became unconscious. The neck hold was quickly released and the subject remained unconscious for approximately 30 seconds. Upon arising to his feet, his shipmates noticed that his eyes were "bloodshot." For the next few hours he had a dull headache and deep orbital pain on rotating his eyes. He reported to the eye department at a naval air station approximately 12 hours after the injury occurred.



Showing subconjunctival and subcutaneous hemorrhages

Case report.—The subject was a 19-year-old, well-developed, white male in no distress. The skin of all four eyelids showed numerous petechial hemorrhages. The tarsal conjunctiva of both lower lids was a dark red. The posterior half of each eyeball was completely surrounded by confluent subconjunctival hemorrhages. This process extended well forward on the left eye to reach the limbus anteriorly. The cornea was clear. There were no cells visible in the aqueous with the corneal microscope. The pupils were round, equal, and reacted well to light and accommodation. Both fundi were normal. Rotation was full in all directions with some deep orbital discomfort. Vision: Right eye, 20/20; left eye, 20/20. Peripheral fields and optic-nerve blind spots were normal. The buccal mucosa did not show any hemorrhages. There were no motor or sensory changes throughout the remainder of the body. Blood pressure was 136/70. Capillary fragility, tested by applying the blood-pressure cuff to the forearm and inflating, did not reveal any increase in fragility. No spinal puncture was attempted.

The subject continued on a light-duty status while under observation for the following week. During this period there were no further developments.

DISCUSSION AND SUMMARY

One can only speculate on the physiological process which took place. The constriction possibly occluded the venous return without

completely shutting off the arterial flow. It is of interest that the process was restricted to the eyes, although time alone will tell whether there were hemorrhages intracranially. The subject did not recall any pain or unpleasant sensation at the time of losing consciousness. His first fright developed later when he realized how close to death he had been.

An unusual case history is presented wherein constriction of the neck produced loss of consciousness and numerous subconjunctival and subcutaneous hemorrhages with no signs of cerebral injury.



HUNTINGTON'S CHOREA

REPORT OF A CASE

JOSEPH D. TEICHER

Lieutenant (MC) U. S. N. R.

Adult chronic chorea was recognized in America as early as the first half of the last century. The affection has been reported from all parts of the world, in colored races as well as white. Many excellent reports have appeared in the literature, yet a typical case of adult chronic chorea is still sufficiently a curiosity to warrant a report.

The original description of the chorea, now commonly labeled Huntington's chorea, after its able observer, stressed three major characteristics of the disease: "(1) Its hereditary nature; (2) a tendency to insanity and suicide; (3) its manifesting itself as a grave disease only in adult life." A fourth should be added: Its progressive course. In every genuine instance of Huntington's chorea, the heredo-familial character of the disease has impressed itself, notwithstanding the lack of any other clear etiologic factors.

Stemming from the major characteristics of the disease, four chief items comprise the classical syndrome, namely: Chorea, mental impairment, adult evolution, and the progressive course. The most usual period of onset is between 34-50 years, and it is slightly more frequent in males. Most cases begin with the onset of choreic movements of the head, face, upper trunk, and arms which at first may not be more than a fidgetiness. The process becomes more severe until in time no skeletal musculature escapes. The gait is of a halting, lurching, jerky character. The earliest mental features are emotional; individual is irritable, curt, readily excited. Or there may be eccentric behavior or transient psychotic episodes. Memory retention

and recall are early intellectual signs, together with inattention. The picture may even resemble general paralysis.

The etiology is unknown and the pathogenesis is controversial. Many believe the disease is the result of a chronic meningo-encephalitis; others point to the abiotrophy of certain ganglion cell systems; still others to progressive gliosis; and some to vascular involution. In any case, there is much unexplained in the pathology and its relation to symptoms. There is no known treatment.

The following case displays many interesting features. The psychological evaluations were done by Lt. (jg) Jane Diamond, H(W) U. S. N. R.

CASE REPORT

The patient, 45 years of age, was admitted to the hospital complaining of diarrhea, difficulty in walking, and tremors of the head. He gave a long history of lower bowel complaints which, after exhaustive investigation, were attributed to a chronic colitis. His complaints of nervousness and tremors brought him to the attention of the neurology service. The following pertinent history was obtained from him with great difficulty in view of obvious mental changes.

In 1940 he had a severe attack of "influenza" following which he was unable to work because of nervousness. By 1944, he noted involuntary head shaking, involuntary muscular movements, and twitching that progressed. He also noted impaired memory and general nervousness. His past history revealed that he was an eighth-grade graduate, unmarried, a veteran of World War I, had not been in combat, that from 1919 to 1921 he had been a professional boxer. Since 1921, he had hoboed throughout the country and had been a patient at many of the more prominent Veterans hospitals.

Family history was interesting. His mother died at age of 45 years of "nervous movements." He described wild, uncontrollable, choreic movements. His father died at age 64 years of "dropsy." An aunt (mother's sister) died of "nervous movements." He had siblings:

R., aged 56, in veterans' hospital as result of "gas wounds";

E., aged 54, baker, married, four children, all well;

J., aged 42, died of fractured skull;

T., aged 50, two children, all well;

J., aged 21, died of pneumonia; and

G., aged 42, has nervousness and uncontrollable movements, "just as I do" according to the patient.

This family had scattered and no verification could be obtained from outside sources.

The *general physical examination* was essentially negative.

Neurological examination.—Gait was jerky and lurching with loss of associated swing of the arms. Station was unsteady and jerky. There were involuntary myoclonic and choreiform movements in most of the skeletal muscles of the body but more especially on the left. Head jerking was marked. There was marked loss of associated movements with clumsiness in both hands. Skilled acts were poorly done. Speech was slurred in test phrases.

Tendon reflexes were overactive throughout but no pathological reflexes were found. Sensory status was normal. Cranial nerves were intact.

During the examination a flat, expressionless facies was noted; speech was jerky but coherent; he was curt and irritable. A poor attention span was evident

with marked memory defect and intellectual impairment. Conceptual thinking was poor; judgment impaired; insight minimal. There was a markedly exaggerated body concern with hypochondriacal tendencies. At times, one could elicit a paranoid trend to his ideas (which is interesting in view of his chronic colitis).

Laboratory data.—Blood, urine, and spinal fluid studies were normal. X-ray examinations of the chest and skull were normal. An extensive gastro intestinal work-up was essentially normal. Unfortunately, the electroencephalogram machine was being repaired during his hospital stay and a reading could not be made.

Psychological.—(1) *Wechsler-Bellevue Adult Intelligence Scale*—Performance I. Q. 79; verbal I. Q. 91; full scale I. Q. 83.

Psychometric examination indicates general mental functioning level to be dull normal at this time but with the extreme scatter in intellectual abilities found in patients with organic brain disease. Premorbid endowment (as measured by range of information and vocabulary and social comprehension) was probably average, but there is now a "net deterioration loss" of 16 percent. Arithmetic reasoning is defective; conceptual thinking ability close to defective; and there is an organic type defect in recent memory or retention in his difficulty in reversing digits and in keeping in mind any complicated question. His consistently low scores on the performance items are further evidence of his rigidity and inability to cope with unfamiliar problems. Specific test responses are significant in that they reveal an occasional confabulatory tendency (the interpretations he offered for his arrangement of the pictures in the picture arrangement subtest). Perceptual or spatial disturbances are also suggested by his difficulty in reproducing visual designs. Throughout the testing procedures, deterioration, as evidenced by increased retardation and perseveration, could be seen after only a short time of testing, and the fact that the testing was divided into three sessions may have helped him in hiding the amount of actual functioning impairment.

This patient gave a Rorschach record which was strongly suggestive of organic brain disease. As the test continued, his performance deteriorated; retardation became marked, rigidity appeared with perseveration of thought and form perception became inaccurate and variable. There was also indication of confusion and an immediate memory defect in that he repeated the same response for the same location with no recollection of having said it before. Throughout, the patient seemed somewhat aware of his inadequacy and appeared mildly perplexed but he did not seem otherwise emotionally upset.

Course.—There was no treatment other than an exhaustive investigation into his various complaints, an investigation which finally satisfied him. He was released to return to a part-time job. Periodic temper outbursts and eccentric behavior were noted during his stay.

COMMENT

In view of the family history, the onset in adulthood, the chorea, the mental changes, and the progressive course the diagnosis of adult chronic chorea or Huntington's chorea was made. This patient illustrated the major symptoms of the disease as well as Huntington's original premises. Like most of the reports in literature, the physical findings were most prominent in the extra-pyramidal system. The mental changes evidenced, undoubtedly produced by underlying brain pathology, were prominent in the emotional and intellectual spheres as was so well shown by his behavior and test performances.

Cases of Huntington's chorea do not often appear in the naval service because of the relatively late age of onset. When one is detected, it constitutes a clinical curiosity as a rare and little understood nervous system disease.



ACUTE APPENDICITIS TREATED WITH PENICILLIN

REPORT OF A CASE

WILLIAM LANDESMAN
Commander (MC) U. S. N. R.

The use of penicillin in the treatment of acute appendicitis will undoubtedly lead to much controversy, especially in cases which are first seen from 24 to 48 hours after the onset of the disease. The decision to operate in the first 24 to 36 hours of the disease hardly will be disputed. However, when the diagnosis is made after a lapse of from 36 to 48 hours it may present a difficult problem, especially to those surgeons who favor operations in all cases of appendicitis. The public, too, will require some re-education because the prevailing belief held by most laymen today is that surgery inevitably follows a diagnosis of appendicitis at any stage. Should there be an unfavorable result after operation is withheld, the doctor handling the case will be criticized severely. In the past an unfavorable result following surgery, even in a poorly selected case, usually brought forth the comment that "at least everything possible was done." The following case is presented because it brings up several points of interest, especially aboard ship.

CASE REPORT

On 23 November 1945 this ship, while at sea, received a message from commander, Western Sea Frontier, directing any ship in the area having a medical officer aboard to contact the S. S. —. The message further stated that they had a man aboard suffering from acute appendicitis requiring immediate medical attention. The merchant marine ship was contacted and an exchange of messages indicated that the patient had been sick 3 days, was being treated with sulfathiazole and was getting worse. Information obtained reasonably seemed to confirm a diagnosis of acute appendicitis. A rendezvous was effected about 24 hours later and the medical officer went aboard the S. S. — to examine the patient.

History.—The patient was a 32-year-old merchant marine oiler, a native of Malta. History obtained from the purser who was in charge of the patient revealed that the date of onset was 16 November 1945, or 8 days previously, when he had been treated for "indigestion." On 17 November there was general-

ized abdominal pain. The patient then continued to have vague abdominal pains and a low-grade temperature (99.2° F.) until 21 November when his pain was definitely localized in the right lower quadrant. On 22 November his temperature rose to 102.6 F. and on 23 November he had a chill and a temperature of 102.4° F. He had received a total of about 42 grams of sulfathiazole up to that time. Too much reliance could not be placed on this history as in some details it did not coincide with the information transmitted to us by radio before making contact.

Examination revealed a well-developed adult male who appeared to be acutely ill, perspiring profusely, complaining of severe abdominal pain and vomiting. The face was flushed, conjunctiva congested, pupils equal, reaction normal; ears normal; throat slightly congested; tongue thickly coated; breath foul; neck normal; heart and lungs essentially normal. There was considerable distention of the abdomen and generalized tenderness throughout but marked over McBurney's point. There was muscle spasm on the right side and there was marked rebound tenderness. The liver was not enlarged; spleen was not palpable, and Murphy's sign was negative over both kidneys. No masses were felt. Rectal examination was negative although not conclusive because the patient would not cooperate. The patient's temperature was 101.4° F., pulse 96, respiration 24, blood pressure 112/72. Complete blood count, done later, showed WBC-16,000, with 81 percent polys, and RBC-4,050,000. Hemoglobin estimation showed 78 percent. Urine was normal except for a few sulfathiazole crystals.

Tentative diagnosis and treatment.—The patient was lowered over the side in a Stokes stretcher to a motor whaleboat and was transferred to the U. S. S. ——. A tentative diagnosis of a periappendicitis or a pylephlebitis was made, and it was decided to treat the patient with penicillin. One thousand cubic centimeters of 5 percent dextrose in physiologic saline solution was given at once. Fifty thousand units of penicillin was given intramuscularly every 3 hours for 3 days, a total of 1,200,000 units. Within 24 hours there was marked improvement, vomiting ceased, and the patient's bowels moved for the first time in 4 days. On the fourth day the temperature had returned to normal and remained so. Recovery from then on was uneventful. The patient was transferred at our next port of call for further treatment.

COMMENT

1. It should be stressed that when vessels at sea request aid from another vessel, great care should be taken to transmit accurate information.

2. The dosage of penicillin used in this case was limited by our supply on hand. Crile and Fulton¹ recommend much larger doses.

3. It is not the intention to draw any definite conclusions from this one case, but considering the marked improvement after instituting penicillin therapy in this case, it is felt that the penicillin was a prime factor in the recovery of the patient. It was felt that surgery at this late stage was definitely contraindicated unless an urgent complication presented itself. The possibility of a spontaneous recovery must always be kept in mind, but we would not hesitate to use this therapy should a similar case occur.

¹ CRILE, G. S., and FULTON, J. R.: Appendicitis, with emphasis on use of penicillin. U. S. Nav. M. Bull. 45: 464-473, September 1945.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

SURGICAL TREATMENT OF THE NERVOUS SYSTEM, prepared under the supervision of *Frederic W. Bancroft, A. B., M. D., F. A. C. S., Associate Clinical Professor of Surgery, Columbia University.* Associate Editor: *Cobb Pilcher, M. D., F. A. C. S., Associate Professor of Surgery, Vanderbilt University School of Medicine.* 534 pages; 293 illustrations, 15 color plates. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1946. Price \$18.

This book on surgery of the nervous system is a rather complete monograph on operative procedures used in neurosurgery. Many of the outstanding specialists of the field in this country have written various sections, which include: Head Injuries by Spurling; Cranioplasty by Woodhall; Tumors by Craig, Shelden, Pilcher, Fincher, and Bucy; Inflammatory Disorders by Kahn and Maxwell; and Epilepsy by Erickson. Surgery of Cranial Nerves is discussed by Peet and Echols, Surgery of Spinal Cord by Naffziger and Boldrey, Surgery of Peripheral Nerves by Coleman, and Surgery of Sympathetic Nervous System by White. Several of the sections are of special interest in that they reflect the experiences of the authors who were in the service during the recent war. Although a certain lack of correlation between the various sections is to be expected in a volume of this sort, the advantages inherent in a book written by a number of authorities in this case outweigh its disadvantages.

In no other single volume can most of the standard operative procedures used today in neurosurgery be found under one cover. There has long been a need for such a text, which is highly recommended not only because of its great interest to neurosurgeons, but also for its value to medical students, general practitioners, and to general surgeons, who will find certain chapters of particular interest. It is beautifully and clearly illustrated.

PHYSICAL METHODS OF TREATMENT IN PSYCHIATRY by *William Sargent, M. B. (Cantab.), M. R. C. P., D. P. M., London, Eng., Medical Officer, Maudsley Hospital; Deputy Clinical Director, Sutton Emergency Hospital; Psychiatric Specialist, E. M. S., Acting Hon. Psychiatrist, Outpatients, West End Hospital for Nervous Diseases; Lecturer on Physical Treatment in Psychiatry, Maudsley Hospital Medical School, and Eliot Slater, M. D. (Cantab.), M. R. C. P., D. P. M., London, Eng., Medical Officer, Maudsley Hospital; Clinical Director, Sutton Emergency Hospital; Acting Assistant Psychiatrist, St. George's Hospital; Lecturer on Etiological Aspects of Psychiatry, Maudsley Hospital Medical School.* 164 pages, E. & S. Livingstone Ltd., Edinburgh, publishers, 1944.

This book is a concise 164-page handbook on treatment of psychiatric patients, mostly war casualties from the Dunkirk battles and air-raids in England. The authors have worked out so-called "physical methods of treatment" which can be adapted to large groups of patients that military hospitals are likely to encounter. They feel that these methods are neglected in most therapeutic psychiatric institutions and should be utilized more extensively, both in civilian and military hospitals. They summarize the insulin treatment of schizophrenia and give an excellent account of the technique used. The use of modified insulin therapy, which is used extensively on neurotics in order to increase their weight and as partial sedation, is clearly expounded and is probably more useful to the ordinary psychiatrist in military hospitals than the other form of treatment. There is a chapter on convulsive therapy which might be valuable where this is being used. There is a summary of the treatment of epilepsy by various anticonvulsants. Chapter 6 is an excellent and detailed account of the use of continuous sleep in the treatment of anxiety states.

The book has a good deal in it in the way of techniques and suggestions that the psychiatrist in the large hospital will find valuable. The authors' criticisms and omissions of the techniques of psychiatric therapy may offend some readers but the usefulness of the techniques described and the clarity of those presented outweigh this objection. The book should be a useful one in any psychiatric library.

APPLIED PHYSIOLOGY by *Samson Wright, M. D., F. R. C. P., and John Astor, Professor of Physiology, University of London.* 8th edition; 944 pages, 367 illustrations, 5 color plates. Oxford University Press, New York, 1945. Price \$7.

This textbook by a distinguished English physiologist is written from the clinical viewpoint. Each physiological process is definitely linked with the features that are important in clinical medicine. There is an attempt to use the same plan in physiology as is followed in surgical anatomy where the anatomic features are definitely linked with surgical procedures. Particularly excellent is the part dealing with the

heart and blood vessels, and of great interest is the section on food rationing and the British experience during the war. As a teaching text, this book should be extensively useful because of its practical arrangement and the simplicity with which each suggestion is presented.

GASTRO-ENTEROLOGY, VOLUME III: LIVER, BILIARY TRACT, PANCREAS, PARASITES AND SECONDARY GASTRO-INTESTINAL DISORDERS AND INDEX by *Henry L. Bockus, M. D., Professor of Gastro-enterology, University of Pennsylvania Graduate School of Medicine, Philadelphia.* Illustrated. W. B. Saunders Company, Philadelphia, Pa., publishers, 1946.

The final volume of this treatise on the gastro-intestinal tract has long been eagerly awaited by the medical profession. Volume III is indeed a fitting companion to the first two volumes and while it has been delayed a considerable time due to war shortages, the binding and paper are up to the usual high standards of this publishing house. The paper at times produces a glare, but this is a minor fault compared to the value received from the printed words. The bibliography, as in volumes I and II, is complete. The illustrations, a number in color, are appropriately placed and very well done.

This volume deals exhaustively with the liver, gallbladder, biliary tract, and pancreas. Gastro-intestinal parasites and secondary infections of the gastro-intestinal tracts are covered to a necessary degree at the end of the volume. While this work can almost be considered an encyclopedia, the clinical (diagnostic and therapeutic) approach is constantly stressed and Dr. Bockus and his colleagues at the University of Pennsylvania are to be congratulated most highly on the completion of this outstanding and comprehensive work. The reviewer knows of nothing in this field which can even compare with these three volumes.

Volume III contains an excellent review of the anatomy, physiology, and function of the gallbladder, liver, pancreas, and biliary tract. The entire book is devoted to the clinical approach and the various anomalies, diseases, and disorders affecting these organs are covered in great detail. The style is concise but easy to read, the clinical side is always stressed and the comprehensiveness of the three volumes is obvious when one looks at the 101 pages of the separate index. This index is very complete and volume III, like volumes I and II, has its own index as well.

It is the reviewer's opinion that this remarkable clinical and reference work should be readily available to every physician, specialist, or general practitioner, who is interested in or treats gastro-intestinal, liver, gallbladder, pancreatic, or biliary tract disorders.

PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge

PHOTOFLUOROGRAPHIC EXAMINATIONS OF THE CHEST OF ALL NAVY AND MARINE CORPS PERSONNEL, 1944-1945

SIDNEY A. BRITTEN

Commander (MC) U. S. N. R.

Presented herewith is a table containing an analysis of the photofluorographic examinations of the chest made of personnel of the U. S. Navy and U. S. Marine Corps during the period 1 July 1944 to 31 December 1945.

This period corresponds to the expansion of the Tuberculosis Control Program which began with the order, published 13 June 1944, requiring an x-ray examination of the chest of all naval and Marine Corps personnel (1) as part of the physical examination to determine fitness for enlistment, appointment, active duty, and separation from the service, (2) of all personnel who had not received such examination during the previous year, and (3) at yearly intervals thereafter of individuals under the age of 30. The previous evolution in the Navy of mass examinations of the chest by means of photofluorography is contained in previous reports, by Chambers and Behrens, 1940 (1) Duncan, 1943 (2), Smiley and Raskin, 1944 (3) and Behrens and Britten, 1945 (4).

Reflected by the table is the difficulty encountered in attempting the application of such a program in the midst of a great war, and with the Navy and Marine Corps expanded to an unprecedented extent. In the face of shortages of material and personnel, it was necessary to transfer photofluorographic equipment to new locations, procure new equipment, train new personnel, and determine quickly the locations which were accessible to the greatest number of persons requiring the examination. It was evident at the start that universal application was impracticable, but a high goal was set and it was determined to achieve 2,500,000 examinations a year, thereby going a long way toward preventing the spread of the disease, and, possibly, bringing about a decline in the admission rate within the service.

It is interesting to note that during September 1945, just before the Personnel Separation Centers began their outburst of activity, the goal had apparently been reached. This success was made possible by the fortunate location of approximately 50 photofluorographic units and by the outstanding cooperation of all concerned in the procurement of equipment and supplies, the selection and training of personnel, the planning and building of suitable quarters, the unremitting devotion to duty of operating personnel, and the transportation of personnel to and from the units.

Equipment was located in Naval Ship Yards, Personnel Distribution Centers, Training Centers, in two mobile units, and in Pearl Harbor. Events in August 1945 caused the interruption of projects under way to provide a floating x-ray laboratory for the fleet, stationary units at Guam and Okinawa, and a mobile unit for Pearl Harbor. Each unit provided facilities for the examination of 10,000 persons each month; not infrequently one or more of the units examined between 15,000 and 25,000 individuals in one month. To man each of these units a medical officer and six hospital corpsmen were required, most of whom had received intensive and specialized training. Only occasionally were the services of previously qualified specialists available.

TABLE

The table is set up in two sections showing action as taken by the photofluorographic units and action as taken by the bureau after review of the film. "Rejected" indicates that the findings, alone or in part, resulted in exclusion of the individuals concerned from military service; "Referred" indicates that the individuals concerned were transferred to a suitable place for clinical study and treatment. The classification includes two categories, those in whom the suspicion of tuberculosis existed, and those in whom the suspicion of other pulmonary, cardiovascular, or intrathoracic disease existed. Further refinement in classification was not feasible, since case-finding by mass examination is inherently a screening process and not a diagnostic procedure.

The columns headed "Bureau Disposition" are incomplete. All suspicious and "positive" films which might have escaped previous attention were carefully traced in order to secure a re-examination by means of a 14 x 17 inch film. Only those cases are reported in which it is known that the individual was actually hospitalized. Following September 1945 the tracing of personnel who have been separated from the service has been undertaken by the U. S. Public Health Service, upon notification by the Bureau of Medicine and Surgery.

Photofluorographic examinations of the chest of all Navy and Marine Corps personnel, 1944-45

Month	Total films received in Bureau of Medicine and Surgery	FIELD DISPOSITIONS						BUREAU DISPOSITIONS			GRAND TOTAL ALL DISPOSI- TIONS	
		Rejected or referred,totals, and rates						Rejected or referred, totals, and rates				
		For TB		For non- TB		Total		Total films reviewed in Bureau of Medicine and Surgery	Bureau dis- positions		Number	Rate per 10,000
Number	Rate per 10,000	Number	Rate per 10,000	Number	Rate per 10,000	Number	Rate per 10,000					
1944												
July	39,000	70	17.9	13	3.3	83	21.2	39,000	9	2.3	92	23.6
August	55,000	57	10.3	26	4.7	83	15.0	55,000	13	2.3	96	17.4
September	47,000	89	18.9	25	5.3	114	24.2	47,000	11	2.2	125	26.6
October	59,000	96	16.3	26	4.4	122	20.7	59,000	9	1.5	131	22.2
November	55,000	72	13.1	19	3.4	91	16.5	55,000	19	3.4	110	20.0
December	66,000	105	15.9	29	4.4	134	20.2	66,000	13	1.9	147	22.3
1945												
January	81,262	145	17.8	33	4.1	178	21.9	81,262	24	3.0	202	24.9
February	79,561	256	32.2	53	6.7	309	38.8	79,561	15	1.9	324	40.7
March	124,416	236	19.0	92	7.4	328	26.4	124,416	29	2.3	357	28.7
April	162,281	342	21.1	125	7.7	467	28.8	162,281	17	1.0	484	29.8
May	154,201	288	18.7	100	6.5	388	25.2	154,201	47	3.0	435	28.2
June	161,721	297	18.4	160	9.9	457	28.3	161,721	20	1.2	477	29.5
July	154,164	391	25.4	179	11.6	570	37.0	154,164	27	1.8	597	38.7
August	201,629	404	20.0	180	8.9	584	29.0	201,629	6	0.3	590	29.3
September	215,583	470	21.8	220	10.2	690	32.0	215,583	12	0.6	702	32.6
October	375,938	714	19.0	182	4.8	896	23.8	321,906	-----	-----	-----	-----
November	371,472	518	13.9	179	4.8	697	18.8	245,842	-----	-----	-----	-----
December	407,193	705	17.3	199	4.9	904	22.2	158,852	-----	-----	-----	-----
Total	2,810,421	5,255	18.7	1,840	6.5	7,095	25.2	2,382,418	1271	1.6	14,863	129.4

¹ Computed from total through September 1945. Rates per 10,000 examinations.

Notwithstanding the incompleteness, it is obvious that at least 3 percent of the total was referred for study as a result of review of the films. This 3 percent error, if error it be termed, conforms fairly closely to the expected personal error of experienced interpreters actively engaged in mass x-ray examinations of the chest.

The final result of the clinical studies initiated by the case-finding is not known at this time. Efforts at correlating the content of the table with admission rates and invalidings from the service, etc., will be made when all the necessary information is available.

In view of the foregoing, no conclusions are drawn.

REFERENCES

1. CHAMBERS, W., and BEHRENS, C. F.: Roentgen photography, U. S. Nav. M. Bull. 38: 297-299, July 1940.
2. DUNCAN, R. E.: Photofluorographic chest survey of naval personnel. Dis. of Chest 9: 269-273, May-June 1943.
3. SMILEY, D. F., and RASKIN, H. A.: Tuberculosis as a Navy problem. Dis. of Chest 10: 210-233, May-June 1944.
4. BEHRENS, C. F., and BRITTEN, S. A.: Five years of photofluorography in the Navy. U. S. Nav. M. Bull. 45: 1203-1207, December 1945.

TYPHUS IN EGYPT DURING WORLD WAR II

JULIUS M. AMBERSON
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Typhus in Egypt during World War II was represented in an epidemic cycle of this disease that has been endemic for years in that area. The disease is chiefly of the "classical" or louse-borne form, widely spread throughout the Nile Valley, but present only in one of Egypt's six oases. It is present in the Fayum Oasis; this oasis being in frequent communication with the Nile Valley. Cities along the Suez Canal have the murine form as well.

The epidemic cycle began in 1941 when the case rate passed the "endemic level" of 40 per 100,000 reaching a case rate of 55.5 per 100,000. There were 9,414 cases of typhus recorded in Egypt in 1941; deaths were 1,739, and the case-fatality rate was 18.5 percent.

Statistics of the present epidemic cycle just prior to World War II and during its course up through the first half of 1945 are herewith tabulated as follows:

Year	Population	Total cases	Cases per 100,000	Deaths	Deaths per 100,000	Case fatality rate
1939	16,450,296	4,296	26.1	788	4.79	18.3
1940	16,709,097	4,416	26.4	800	5.15	19.5
1941	16,967,898	9,414	55.48	1,739	10.25	18.5
1942	17,226,699	22,054	128.02	4,183	24.3	19.0
1943	17,485,500	40,084	229.24	8,104	46.35	20.2
1944	17,545,000	18,587	105.9	3,132	17.85	16.85
1945 (to June 17)	(estimated)	16,051	-----	1,861	-----	11.59

In a series of 1,100 cases of typhus studied at the Imbaba Fever Hospital, Cairo, in the spring of 1944, there were 599 males and 501 females in all age groups having typhus. The probability is that both sexes are equally susceptible.

Deaths from typhus are higher as a rule among Egyptian males. Out of 1,100 cases observed, there was a total of 159 deaths. Of these 105 were males and 54 females, or a ratio of 2 to 1 respectively.

In a series of 196 cases of typhus gathered at random for the purpose of determining the predominate clinical signs and symptoms of typhus, these were found to be as follows:

Clinical sign or symptom	Cases	Percent
Dry swollen coated tongue	173	88
Headache	171	87
Lethargy or malaise	156	70
Injected eyes	145	73
Rash (mostly macules; some petechiae, papules, and scaling)	148	75
Chattering speech	144	73
Cough	112	57
Tinnitus	107	54
Râles in chest	98	50
Deafness	96	49
Bronchial pneumonia (consolidation 57)	66	34
Chill	65	33
Pain	60	30
Disorientation	39	19
Palpable spleen	35	17
Productive sputum	30	15
Difficulty to protrude tongue	14	7
Decubitus	10	5
Pleuritis	6	3
Renal insufficiency	4	2

There were complications found in 33 cases such as otitis media, favus, yaws, scabies, laryngitis, hernia, prolapse of rectum, leprosy, diarrhea, anemia, emaciation, hiccough, jaundice, edema of legs, gallop rhythm of heart.

A considerable portion of the Egyptian Armed Forces was immunized during 1944. The civilian population generally did not receive typhus vaccine but some selected communities, hospital personnel, and public health workers of those vaccinated natives, some Egyptian public health inspectors and nurses were immunized.

SUMMARY

Epidemic typhus in Egypt is now in the fifth year of a 7- or 8-year cycle. It is definitely on a downward trend; the peak of the cycle having been passed in 1943.

Statistical data indicate the immensity of the epidemic and its fatal character.

Case-fatality rates show that over a long period of time typhus has been consistently fatal in about 20 percent of cases. Any therapeutic agent that might be discovered should improve on this figure considerably to be significant.

Preventive and insecticidal measures so effectively used among the Armed Forces during the war will undoubtedly be practiced extensively among Egyptians in the years to come.

Immunization with the present vaccine apparently protects against having the disease in a severe form but it does not prevent incurring the infection in a mild form.

TYPHUS CONTROL

Louse control in endemic areas.—As mosquito control is to malaria, louse control should be to typhus. Whenever it is possible to prevent

the establishment of a large louse population, typhus will be under control. As a corollary, it would be wise whenever possible in important endemic areas to dust whole populations with DDT once in summer and once in the fall before the typhus season begins. As soon as the minimum temperature falls below 75° F. careful watch should be kept for the outbreak of an epidemic, for temperature seems to be a factor in the typhus picture and merits further study.

The first requisite in typhus control work is to have on hand an adequate supply of DDT with an efficient method of distributing and applying it. Each lot should be of course tested for potency before mixing and again after it has been made into a 10 percent mixture with a diluent. Well before an epidemic is expected, every effort should be made to improve general sanitation. A "clean-up week" or other popularized campaign should be instituted.

This should include instruction, organization of clean-up groups, and every possible effort to have each family clean up its own dwelling, clothes, and animals. If this is done in association with a dusting plan, the control of the lice population may be significantly increased.

Rat and flea control.—Rats and their fleas at times become a problem in endemic areas where murine typhus exists. If such is the case, then it will be necessary to broaden the campaign to control this reservoir and vector.

Isolation of early cases.—Early cases can only be found when clinical thermometers are used to check temperatures of patients. Early case finding must be one of the cardinal procedures in preventing the spread of typhus.

Hospitalization.—Earlier isolations are obtained by bringing mobile hospitals to an epidemic area than to remove persons far from their homes. Those that are sick can be collected within an hour of their being found and placed in the mobile hospital, thus preventing further spread of the disease from these cases.

Typhus vaccine.—Potent vaccine for the prevention of typhus will come into extensive use. Insofar as possible in endemic areas, it should be made available to all people.

Protection of public health workers.—The value of vaccination in the protection of key personnel, heavily exposed to typhus should be reexamined. If three times the present dose among key personnel is needed to prevent the disease, then it should be used.

Improved case reporting.—The establishment of criteria for the existence of an epidemic of typhus is necessarily more important than that for Vincent's angina. In our opinion, if one case of typhus exists and it has passed to another case, it is time to be alert and take stern control measures. Every obscure case of illness should be regarded suspiciously as typhus until it is proven otherwise.

Coordination of control work.—Determine original cases and chart the spread of the epidemic as a means of determining the lines of control. In this way obvious methods of spread can be located early.

Public health education.—Movies on louse control, sermons on cleanliness, school lessons, visual aids, and posters of all kinds should be used in a campaign carefully planned to appeal to every person's capabilities. An opportunity is here presented during the application of these control measures to teach the social significance of science. Typhus control should extend an opportunity to all people in endemic areas to learn about its cause and how to prevent its spread.



TREATMENT OF HUMAN ANTHRAX WITH PENICILLIN

The author treated a case of anthrax "with a combination of penicillin intramuscularly and sulfapyridine orally. In addition, penicillin solution, 500 units to 1 cc. was applied locally twice a day. The result was most satisfactory, both from point of view of control of toxemia and of the local destruction of tissues. On discharge, the damage was found to be surprisingly limited and no plastic repair was necessary.

"In view of the satisfactory results obtained with sulfapyridine, with penicillin, or with both, there would appear to be no indication now to employ the Sclavo serum, a treatment I found expensive, troublesome to the patient, and not so satisfactory as regards immediate response as well as the cosmetic result."—AHMAD, S.: Treatment of human anthrax with penicillin. *Indian M. Gaz.* 80: 623, December 1945.

NOTES ON NAVAL RESERVE CONTRIBUTORS

- Amberson, Julius M.**, Commander (MC) USNR (*Typhus in Egypt During World War II*, p. 1482). E. M., Montana School of Mines, 1921; M. D., Rush Medical College, 1927. Intern, 1926-27, attending surgeon, 1927-42, Norwegian-American Hospital, Chicago, Ill.; private practice, Chicago, 1927-42. Fellow American Medical Association; member: Illinois State Medical Society, Chicago Medical Society, and American Public Health Association.
- Brett, Wilbur B.**, Commander (MC) USNR (*Treatment of Impetigo at a Tropical Base*, p. 1439). A. B., Columbia University, 1934; M. D., New York Medical College, Flower and Fifth Avenue Hospitals, 1937. Intern, 1937-39, and resident in medicine, 1939-40, New York City Hospital, Welfare Island; clinical assistant in medicine: French Hospital, New York City Hospital, Downtown Hospital, New York City. Member New York County Medical Society.
- Britten, Sidney A.**, Commander (MC) USNR (*Photofluorographic Examinations of the Chest of All Navy and Marine Personnel, 1944-1945*, p. 1479). A. B., Hamilton College, 1927; M. D., Syracuse University College of Medicine, 1931. Intern, Hospital of the Good Shepherd, Syracuse University, Syracuse, N. Y., 1931-32; Trudeau School of Tuberculosis, 1933; instructor in medicine, Syracuse University College of Medicine, 1934-; assistant in medicine, Hospital of the Good Shepherd, Syracuse University, 1934-; physician, tuberculosis clinic, Health Department, City of Syracuse, 1935; attending physician, General Hospital, Syracuse, 1936-; private practice, internal medicine and diseases of the chest, Syracuse, 1933-. Member American Medical Association; American Trudeau Society; American Public Health Association; American College of Chest Physicians; Syracuse Academy of Medicine.
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- Candel, Samuel**, Commander (MC) USNR (*Sulfadiazine and Penicillin in the Treatment of Scarlet Fever*, p. 1423). B. S., College of the City of New York, 1925; M. A., Columbia University, 1926; M. D., Jefferson Medical College, 1930. Intern, Jewish Hospital, 1930-32, and Kingston Avenue Hospital, 1932, Brooklyn, N. Y.; assistant in medicine, Jewish Hospital; clinical assistant in medicine, Metropolitan Hospital, Welfare Island, New York City; clinical instructor in medicine and cardiology, New York Medical College, Flower and Fifth Avenue Hospitals. Fellow American Medical Association;

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Crofoot, Michael, Lieutenant Commander (MC) USNR (*Stevens Johnson's Disease, Report of a Case*, p. 1466). A. B., Stanford University, 1934; M. D., Harvard Medical School, 1937. Intern, Haymes Memorial Hospital, September–January 1938, and Worcester City Hospital, April 1938–May 1940; associate resident in pediatrics, University of Michigan, September 1940–July 1941, and Children's Hospital, Cincinnati, Ohio, July 1941–August 1942.

Farrow, Joseph H., Commander (MC) USNR (*The Cancer Problem in the Navy*, p. 1408). B. S., University of Virginia, 1926; M. D., University of Virginia Department of Medicine, 1930. Intern, St. Elizabeth's Hospital, Richmond, Va., June 1930–July 1931; resident in surgery, Watts Hospital, Durham, N. C., July 1931–January 1933; fellow in neoplastic diseases, Memorial Hospital for the Treatment of Cancer and Allied Diseases, N. Y. City, January 1934–July 1937; private practice, surgery and radiology, N. Y. City, 1937–; assistant attending surgeon, Memorial Hospital for the Treatment of Cancer and Allied Diseases, N. Y. City; consulting oncologist, Vassar Brothers Hospital, Poughkeepsie, N. Y.; consultant surgeon; Harlem Valley State Hospital, Wingdale, N. Y., and Nyack Hospital, Nyack, N. Y. Member: American Medical Association, New York State Medical Society, New York County Medical Society, American Radium Society, American Association for Cancer Research, and American College of Radiology. Diplomate American Board of Radiology.

Fullgrabe, Emil A., Lieutenant Commander (MC) USNR (*Isolation and Identification of Enteric Pathogens at a Naval Base in North Africa*, p. 1398). B. S., Lewis Institute, 1934; M. S., Loyola University, 1937; M. D., Loyola University School of Medicine, 1938. Intern, Mercy Hospital, Des Moines, Iowa, 1938–39; private practice, Indianola, Iowa, 1939–42. Member Iowa State Medical Society.

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Wolpaw, Benjamin J., Commander (MC) USNR (*Orbital Hemorrhages Following Pressure on Neck*, p. 1469). A. B., Western Reserve University, 1925; M. D., Western Reserve University School of Medicine, 1928. Intern, 1928-1929 and assistant resident in Surgery, 1929-30, St. Vincent Charity Hospital, Cleveland, Ohio; resident in Surgery, City Hospital, Cleveland, 1930-31; resident surgeon, Wills Hospital, Philadelphia, Pa., 1931-33; visiting ophthalmic surgeon, City Hospital, Cleveland, 1934-38; visiting ophthalmic surgeon, St. Luke's Hospital, Cleveland, Ohio, 1938-42. Fellow American Medical Association and American Academy of Ophthalmology and Oto-Laryngology. Diplomate American Board of Ophthalmology.

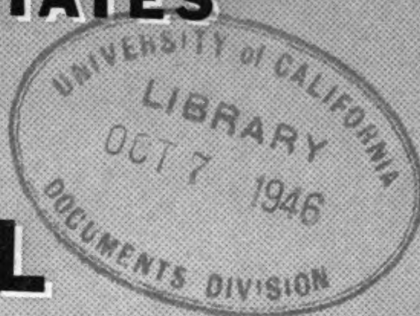
Wood, David A., Commander (MC) USNR (*Notes on Biopsy*, p. 1453). A. B. Stanford University, 1926; M. D., Stanford University School of Medicine, 1930. Pathologist, Stanford University Hospitals, San Francisco; consulting pathologist: Woodland Clinic Hospital, Woodland, Calif.; Mary's Help Hospital, San Francisco; visiting pathologist, San Francisco Hospital and Laguna Honda Home; associate professor of pathology, Stanford University School of Medicine; secretary, California State Cancer Commission.

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UNITED STATES NAVAL MEDICAL BULLETIN



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MEDICINE AND SURGERY
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WASHINGTON, D. C.

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COVER PHOTOGRAPH

A Navy nurse checks up on the condition of her patients in the ward of a naval hospital. Ensign Estelle Sauk (NC) U.S.N.R. is the nurse shown in the picture.

—Official U. S. Navy Photo.

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THE MISSION OF THE MEDICAL DEPARTMENT OF THE NAVY
TO KEEP AS MANY MEN AT AS MANY GUNS
AS MANY DAYS AS POSSIBLE



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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying Medical Department personnel of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical and dental officers.

With the establishment of the Nurse Corps in 1908 and the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of those Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, editorial comment on current literature of special professional interest to Medical Department personnel, clinical notes on interesting cases, descriptions of suggested devices, reports from various sources, notes and comments on topics of professional interest, and notices of newly-published professional books.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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Accuracy and completeness should be employed in all citations (references, bibliography, etc.) as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify the publications and quotations cited. The style used in the **BULLETIN** should be followed as closely as possible. The author of an article is considered responsible for the accuracy and completeness of bibliographical references.

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All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

LOUIS H. RODDIS, *Editor,*
Captain, Medical Corps,
United States Navy.

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SPECIAL ARTICLES

FURTHER STUDIES ON THE USE OF TANTALUM FOR CRANIOPLASTIES

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Tantalum was first used on 24 November 1941 at the United States Naval Hospital, Washington, D. C. to repair a large cranial defect upon the recommendation of Captain F. R. Hook, Medical Corps, U. S. Navy. So far as known this is the first use of tantalum in the repair of a cranial defect in the human subject. The plate was .025 inch thick and was used as an inlay resting on a prepared ledge of bone thus separating the periosteum and endosteum. There were three perforations present in the plate to permit the escape of any underlying collection of fluid. The patient was a fireman from a submarine who returned to that duty on January 16, 1942, after qualifying by special examination, including the ability to withstand air pressure of 50 pounds to the square inch.

Another large cranial defect was successfully repaired with tantalum on 25 April 1942. Considerable damage to the brain existed in this second patient, however, which disqualified him for further naval service. The author was subsequently assigned such duty that he was unable to pursue his interest in cranioplasties until 1945. He did present a report of the first case to the Washington Academy of Surgeons on April 10, 1942, publication of which was unavoidably delayed for almost a year.

Renewed interest in new alloplastic materials for cranioplasty was stimulated by Geib (2) who reported in 1941 the use of vitallium. Peyton and Hall (3) during the same year and Beck (4) during 1942 reported their experiences with this alloy.

Pudenz (5) demonstrated that small cranial defects of cats repaired with tantalum closed by new bone formation and that there was no tissue reaction to the metallic implant. His research appeared to indi-

cate that if the two membranes, periosteum and endosteum, were kept separated by the alloplastic plate osseous formation could occur.

Conley (6) repaired a large frontal defect with tantalum. Reeves (7) used tantalum wire to hold the plate in situ. Robertson (8) used wire or triangular trimmings of tantalum, to immobilize the implant. He used plates successfully in contaminated wounds of five patients with the aid of chemotherapy. Gardner (9) reported in December 1944 the immediate use of tantalum in two cases to repair compound fractures of the skull which was done to immobilize the wounded brain. In March 1945 Gardner (10) quoted Craig as demonstrating that the brain pulsates in a trephined skull whereas it does not in a closed one, and stated he thought that a trephined skull permits the brain to remain in a pathologic state of motility. Furthermore, he continued. Grant and Norcross (11) had demonstrated that 18 of 27 patients had been relieved of epilepsy when nothing had been done except to repair the cranial defects and he reasoned that immediate repair of the cranial defect would eliminate the "syndrome of the trephine" and may at times prevent the development of epilepsy. Falconer and Russell (12) showed that there may be progressive gliosis and atrophy of the pulsating brain beneath a cranial defect. In rabbits Gardner demonstrated that small pieces of tantalum did not retard the healing of infected wounds.

Hemberger, Whitcomb, and Woodhall (13) reported a complicated method of prefabricating the tantalum plate. Harris and Woodhall (14) made a great contribution when they demonstrated that a pedicle graft could be applied over this element. Mayfield and Levitch (15) used tantalum wire to fix prefabricated plates but suggested that tantalum screws would be more convenient if they were available. They emphasized the necessity of making perforations to afford adequate blood supply to the scalp. Woodhall and Spurling (16) reported the use of tantalum to repair cranial defects of 79 patients. They fastened the plate with tantalum wedges. Woolf and Walker (17) in their classical article reviewed cranioplasties and reported on the use of methyl methacrylate.

Bakody (18) reported 40 cases in the Navy, had used tantalum of 15 to 20 mils thickness, but recommended a thickness of 25 mils because in one instance the plate had bent. He illustrated the importance of perforating the plate by recording a failure when a solid one had been used. He found the ball-peen hammer and concave wooden anvil were adequate equipment to effect the desired contour of the plate. Voris (19) made a complete review of cranioplasties and discussed the indications. He thought that abnormal spinal fluid, contaminated wounds, and neurological disability represented contraindications.

He advocated multiple perforations of the plate and some type of fixation.

During the summer of 1945 the writer performed sixteen additional cranioplasties using tantalum. All these patients had received their original injuries during combat duty and had been transferred to the mainland.

All patients who had cranial defects were recommended for repair after the original wound had remained healed for a period of 2 weeks. Three patients who had cranial defects of approximately one-third of the skull were not operated upon as the wounds failed to heal before the author was transferred. Sulfadiazine and penicillin were frequently given to the patient for 1 day before the operation and for 5 days post-operatively.

The plate selected was 25 mils thick if it were available. Multiple perforations were made with a drill at 1-centimeter intervals.

On the evening preceding surgery after the patient's scalp had been shaved, a cardboard was trimmed to the exact size of the defect. The tantalum plate was then cut with tinner's shears so that it had a border approximately 1 centimeter larger than that of the cardboard. An homologous area to that occupied by the defect was then selected on the scalp of the patient and the size of the defect marked with a blue pencil. With a ball-peen hammer and a concave wooden anvil, the plate was beaten into the desired contour using the designated homologous area as the model. If the defect involved the frontal bone and there existed no homologous area, the depressed site was filled with dental plaster until the desired cosmetic contour had been acquired. The reconstructed contour was then used as a model. Triangular spaces were cut in the border of the plate at intervals to permit it to be more inverted. The plate and tinner's shears were then sterilized with the instruments.

Under local anesthesia the scars were excised and the osseous defect exposed after appropriate cleansing of the scalp and the usual draping of the patient. Accessible foreign bodies if present were removed from the brain substance. If a dural defect existed it was repaired with fascia lata. The periosteum was then elevated from the cranial border and the plate placed over the defect so that its dimension on the outer table might be marked with a periosteal elevator. The size of the plate was further adjusted frequently with the tinner's shears. A groove was then cut along the mark with a T-shaped chisel that had a vertical blade 0.03 inch long. The outer diploe was then removed to this depth and the plate inserted on the ledge. Pressure was then made on the dome of the plate with a wooden hammer and the latter was tapped with another hammer which caused the border to spread, thus securely anchoring it. The available periosteum was spread

over the border of the plate and the scalp sutured with a single interrupted row of silk sutures. A snug bandage was applied.

There were no deaths or infections. One plate which was not perforated had to be removed because the wound did not heal. Four patients were transferred to other hospitals before statistical studies could be made but their wounds had healed. All except one had good cosmetic results. Of the eleven who were adequately studied only two continued to have any symptoms. In one patient the plate was over the superior longitudinal sinus and in the other it was over the transverse sinus. The visual disturbances of two patients were not affected by the cranioplasty. None of the patients presented symptoms of convulsive seizures. An average of less than 3 months had elapsed between the time of the original injury and the plastic repair.

A Veterans' hospital was visited and several patients observed who had had cranioplasties. One of this group had had a large cranial defect repaired with a tantalum plate of 0.015 inch thickness used as an onlay. The plate had become bent and was compressing the intracranial contents. The border which had become elevated was producing a red ring about the overlying scalp thus threatening its viability. The tantalum wedge of another patient had caused a necrosis by pressing upward against the scalp exposing the plate. The wound over another large plate had not healed; inspection and x-ray studies revealed that no perforations of the alloplastic material had been made.

COMMENTS

The repair of a cranial defect is an important plastic procedure. The effort to obtain a better cosmetic result represents only one consideration. The chief indications are the relief of symptoms, the protection of the underlying intracranial contents, and the prevention of progressive damage to the brain caused by the pulsating organ. Since cranioplasty accomplishes these purposes so adequately, it is mandatory that it be performed as early as possible following the creation of the bony defect. The indications for cranioplasty have existed throughout the ages but the lack of any uniformly successful method for performing this procedure has prompted surgeons to minimize the problem. Experience with the tantalum plate has demonstrated that it can be buried in soft tissues and that bone will regenerate over it providing certain fundamental procedures are executed.

The tantalum plate must be thick enough to afford adequate protection to the intracranial contents. This is especially true for military personnel who will return to duty. Otherwise, the plate will bend and may constitute a hazard to the brain which it has been used to protect.

Multiple perforations are necessary to permit adequate interchange of fluid and adequate development of blood supply to the osseous membranes and to the scalp. Failure of the overlying wound to heal has been demonstrated to result from the use of nonperforated plates.

The plate should be used as an inlay. This technique permits the osseous membranes to be kept separated, thus promoting their production of new bone, the ideal repair. Whether or not bone will be formed depends upon adequate blood supply which may be made possible by the perforations of the plate. Furthermore, the method described securely immobilized the plates without introducing surgical procedures, or additional pieces of tantalum.

Recent developments of chemotherapy have enabled the surgeon to use metallic implants earlier after the original injury and even in contaminated and infected wounds in selected cases.

CONCLUSIONS

Cranioplasty is indicated for a cranial defect because the latter produces symptoms and permits the brain to be in pathologic motility. Also a repair should be performed for cosmetic, sociological, and psychic reasons. The use of tantalum represents a safe and uniformly successful method. Tantalum was first used clinically for cranioplasty by officers of the Medical Corps of the Navy.

REFERENCES

1. FULCHER, O. H.: Tantalum as metallic implant to repair cranial defects: preliminary report. *J. A. M. A.* 121: 931-933, March 20, 1943.
2. GEIB, F. W. Vitallium skull plates. *J. A. M. A.* 117: 8-12, July 1941.
3. PEYTON, W. T. and HALL, H. B.: Repair of defect with vitallium plates. *Surg.* 10: 711-715, November 1941.
4. BECK, C. S.: Repair of cranial defects by ready made vitallium plates. *J. A. M. A.* 118: 798-799, March 7, 1942.
5. PUDENZ, R. H.: Repair of cranial defects with tantalum. *J. A. M. A.* 121: 478-481, February 13, 1943.
6. CONLEY, J. J.: Tantalum implant in correction of defect following removal of frontal osteoma. *Arch. Otolaryng.* 40: 295-298, October 1944.
7. REEVES, D. L.: Tantalum in repair of traumatic cranial defects. *Bull. Los Angeles Neurol. Soc.* 9: 112-119, March-June 1944.
8. ROBERTSON, R. C. L.: Tantalum in repair of traumatic cranial defects. *J. Neurosurg.* 1: 227-236, July 1944.
9. GARDNER, W. J.: Tantalum in immediate repair of traumatic skull defects; method of immobilizing wounded brain. *U. S. Nav. M. Bull.* 43: 1100-1106, December 1944.
10. GARDNER, W. J.: Closure of skull defects with tantalum. *Sur., Gynec., & Obst.* 80: 303-312, March 1945.
11. GRANT, F. C. and NORCROSS, N. C.: Repair of defects by cranioplasty, *Ann. Surg.* 110: 488-512, October 1939.
12. FALCONER, M. A., and RUSSELL, D. S.: Experimental traumatic cerebral cysts in rabbit. *J. Neurosurg.* 1: 182-189, May 1944 (Quoted by Gardner (9)).

13. HEMBERGER, A. J., WHITCOMB, B. B., and WOODHALL, B. Technique of tantalum plating of skull defects. *J. Neurosurg.* 11: 21-25, January 1945.
14. HARRIS, H. M., and WOODHALL, B.: Plastic closure of skull defects; case report illustrating use of tantalum plate and pedicle-tube graft. *Surgery* 17: 422-428, March 1945.
15. MAYFIELD, F. H., and LEVITCH, L. A.: Repair of cranial defects with tantalum. *Am. J. Surg.* 67: 319-332, February 1945.
16. WOODHALL, B., and SPURLING, R. I.: Tantalum cranioplasty for war wounds of skull. *Ann. Surg.* 121: 649-671, May 1945.
17. WOOLF, J. I. and WALKER, A. E.: Cranioplasty; collective review. *Surg., Gynec., & Obst.* 81: 1-23, July 1945.
18. BAKODY, J. T.: Tantalum cranioplasty. *Ohio State M. J.* 42: 29-32, January 1946.
19. VORIS, H. C.: Repair of skull defects with special reference to use of tantalum. *Surgical Clinics of North America.* 26: 33-55, February 1946.



EOSINOPHILIA, ANCYLOSTOMIASIS, AND STRONGYLOIDOSIS IN THE SOUTH PACIFIC AREA

Authors' summary and conclusions.—1. In certain areas of the South Pacific eosinophilia has been closely correlated with recently acquired hookworm or *Strongyloides* infection; consequently its detection has served as a convenient and rapid tool for the investigation of the natural history and epidemiology of these conditions.

2. Even light infections may be associated with a marked eosinophilia during the first 4 months. Consequently, before drawing conclusions concerning the significance of the eosinophilia many stool examinations may be necessary to demonstrate the ova or larvae, even if sufficient time has elapsed for oviposition to have taken place in the intestine.

5. The infection affects chiefly front-line infantry soldiers, is in the main acquired during combat, is proportional in extent to the duration of the fighting, and is increased by the use of native or captured enemy bivouac areas.

6. *Ancylostoma duodenale* has been the common species in troops infected in the islands of the South Pacific.

7. Biological cure, using tetrachlorethylene, has been difficult to attain, even in lightly infected individuals.

8. Continued re-exposure of the large number of men already involved, as by further campaigning in heavily seeded areas, or a decline in the quality or amount of the diet, may convert subclinical infection into disease of military importance.—LIEBOW, A. A. and HANNUM, C. A.: Eosinophilia, ancylostomiasis, and strongyloidosis in the South Pacific area. *Yale Journal of Biology and Medicine* 18: 381-403, May 1946.

A SIMPLIFIED TECHNIQUE FOR THE FABRICATION OF TANTALUM SKULL PLATES

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Foreign materials have been used in surgery almost since the beginnings of civilization, when the early Egyptians used to drive the teeth of animals into the sockets of extracted teeth. Burke attributes the first use of metal in surgery to Petronius, who used gold to close palatal defects in 1565. Since that time, silver, lead, tin, copper, zinc, aluminum, iron, nickel, bronze, German silver, and other metals have been used surgically, in one form or another, almost entirely unsatisfactorily, since oxidation or corrosion is caused by the oxy-hemoglobin of the blood, and the metal is not tolerated by the surrounding tissues.

More recently, vitallium, an alloy of cobalt, chromium, and molybdenum, has been used with a higher degree of success. However, vitallium has an extremely low index of malleability and ductility, and thus must be cast for any purpose for which it is to be used. Special equipment is necessary for casting. With vitallium, also, there is the possibility of the formation of chromium salts, by oxidation, the cumulative effects of which would be harmful.

The element tantalum (atomic weight 180.88; atomic number 73), discovered by the Swedish scientist Ekeburg in 1802, seems to satisfy most of the requirements for a metal to be used surgically. Tantalum is similar to steel in color, strength, and ductility, but is twice as dense, and becomes fatigued, or work-hardened, at a much slower rate. Tantalum compares with glass in its resistance to the body chemistry and is markedly resistant to all acids, being acted upon only by hydrofluoric acid, concentrated sulfuric acid, and concentrated, strong alkalis, and their salts at atmospheric conditions. Burch, Carney, and Burke, the first to make surgical use of tantalum, believe it to be a physiologically inert metal. This opinion has since been confirmed by Pudenz, Craig, Hook, and others. Tantalum is apparently resistant to corrosion because its oxide, which is thin and transparent, is also extremely strong and tenacious, and forms a protective film over the tantalum. The density of bone close to tantalum increases, and



FIGURE 1.—Cranial defect before repair. FIGURE 2.—Same defect after cranioplasty with insertion of tantalum skull plate.

adjacent periosteum becomes thickened. The tantalum itself becomes surrounded, in the body, by a thin, fibrous connective tissue envelope, which, upon microscopic examination, is seen to be composed of healthy fibroblasts.

Tantalum is of particular value in cranioplasties, as it can be readily pressed into the required shape to repair the cranial defect. It is only moderately expensive as special equipment and specially trained personnel are not required for its processing. Usually, one sheet is sufficient to accomplish three or four repairs. Actually, the fabrication of the tantalum plate can be carried on with the equipment found in any dental laboratory. Dental training is not essential to the preparation of the process, and by following the procedure outlined in this article the neurosurgeon can readily press his own plates, which can be used in either the inlay or onlay technique of insertion.

Tantalum is obtainable in sheets 6 by 6 inches, and in thicknesses of 0.0125, 0.0150, and 0.020 inch. The 0.0150-inch thickness is desirable for most skull plates as it can be readily pressed and is sufficiently strong to resist change in shape as a result of any ordinary force to which the human head may be subjected.

The procedure for the fabrication of satisfactory plates can be considered as consisting of six steps, (1) the impression, (2) the model, (3) the corrected model, (4) the die and counter-die, (5) pressing the plate, and (6) the finishing.

The impression.—The defect is outlined on the skull with indelible pencil by the neurosurgeon. This pattern will be transferred to the impression, when it is taken. There is no need that the pattern be established at the time the impression is taken. It can be drawn several hours, or even several days, before the impression is made.

An impression of impression plaster is the easiest to take and is entirely satisfactory for most defects. If there is hair remaining in the vicinity of the defect, a cardboard, or other matrix may be used, otherwise, no matrix is necessary (fig. 3). It is advisable to extend the impression at least 2 inches beyond the defect in all directions. After removing the impression, the outline should be re-marked in indelible pencil, so that it will be transferred to the model (fig. 4).

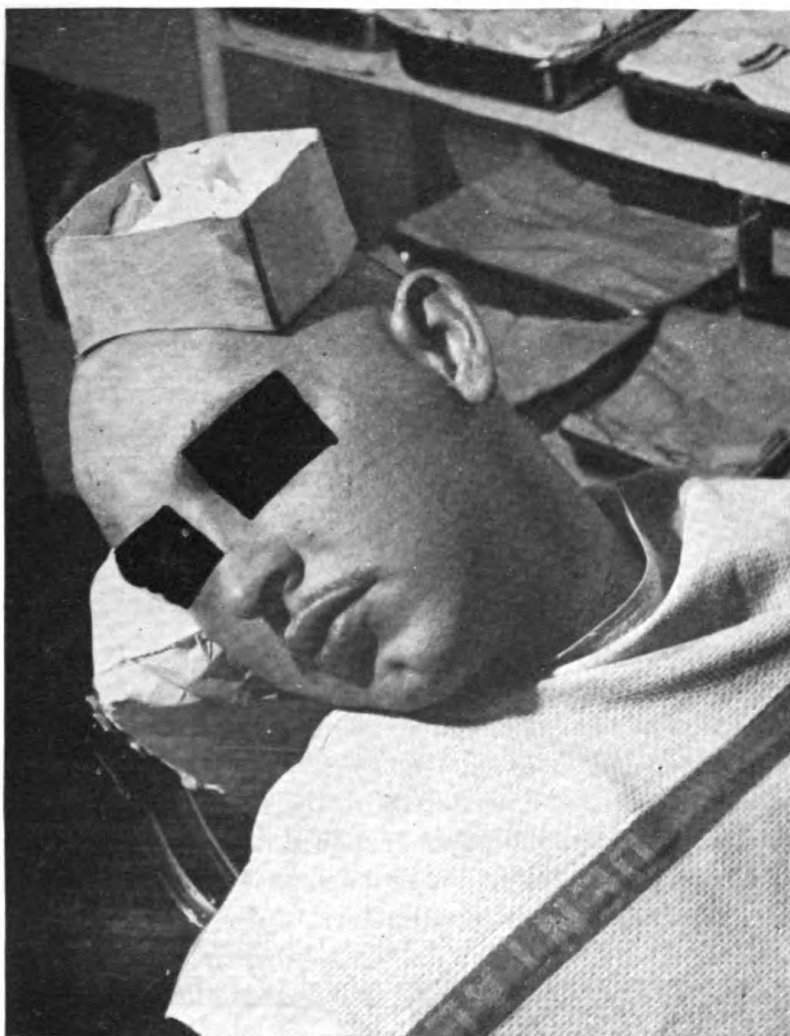


FIGURE 3.—Taking impression with cardboard matrix.

In the case of defects which involve, or approach, the supra-orbital margin or temporal line of the frontal bone, it is desirable to take an impression sufficiently large so that it will include the entire frontal area, both eyes, and parts of both temporal regions. It is necessary to have an impression of this sort, so that, in correcting the defect, the normal side can be used as a guide and so that satisfactory esthetics can be developed in the tantalum plate. Impression plaster is not very satisfactory for an impression of this sort, as it is difficult to

remove when there are undercuts and the eyebrows and eyelashes tend to become incorporated into the set impression. Hydrocolloidal impression materials of either the regular or alginate type are very satisfactory in these cases. The material can be applied to the entire area, including the closed eyes, with a paint brush, and is built up to a thickness of about one-fourth inch. After the hydrocolloid has set, a mixture of impression plaster should be applied over it to act as a support, or "tray."

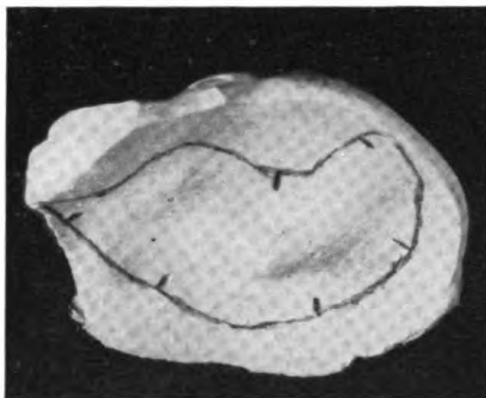


FIGURE 4.—Plaster impression, outlined. Areas for retention holes indicated.



FIGURE 5.—Artificial stone model with outline re-marked with indelible pencil.

The model.—After a satisfactory impression has been obtained, it should be matrixed and an artificial stone model poured. When the impression has been separated, the pencilled outline of the defect will have been transferred to the model. This outline should be re-marked in indelible pencil (fig. 5).

The corrected model.—The defect on the model should now be corrected in wax. This waxed pattern should be slightly over-contoured for thin-scarred scalp tissue. The pattern should also be extended about 1 cm. beyond the outlined pattern, unless the neurosurgeon, in marking the original defect, has made this allowance. The model should be slightly lubricated before the wax is applied so that the wax pattern can be easily separated (fig. 6).



FIGURE 6.—Corrected model. Contour developed in wax.

In cases where the defect is very large, or where there will be many curved surfaces in the finished plate, the model should not be lubricated, but the wax should be applied directly, and

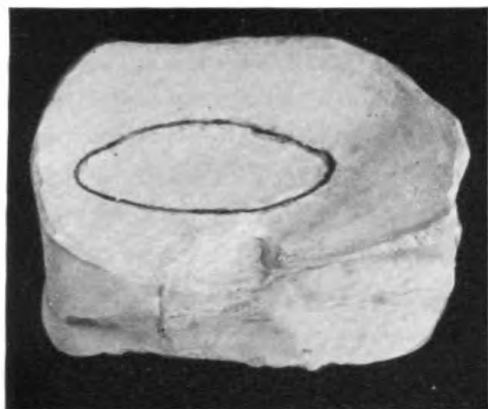


FIGURE 7.—Artificial stone die.

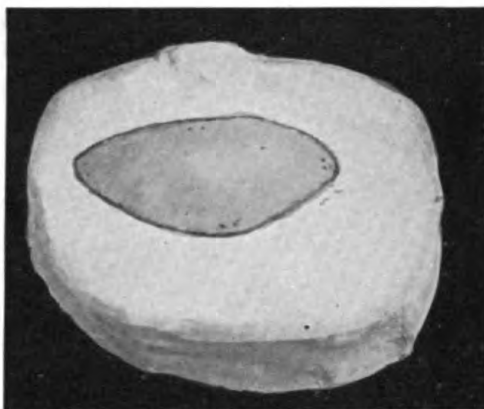


FIGURE 8.—Artificial stone counter-die.

should be built up so that the correction is about one-eighth inch less than the desired contour. The area should then be lubricated, a layer of plasticine applied, and the final contour developed, the reason for which will be described hereafter.

The die and counter-die.—The die and counter-die will be discussed together as their preparations are similar, and since two methods of processing may be used, each method must be discussed as a unit.

For the average-sized plate, artificial stone dies and counter-dies can be used very successfully, especially if they are reinforced by twisting coat-hanger wire around their peripheries. The stone die is made by matrixing the corrected model, applying separating medium, as soap solution, and pouring the artificial stone to a thickness of at least 2 inches (fig. 7). After the die has set, it is separated from the corrected model, matrixed, separating medium applied, and an artificial stone counter-die of the same thickness poured (fig. 8).

For very large defects, or where there are several curves following different planes, stone dies and counter-dies are liable to crack or crumble, during the pressing procedure. In situations of this sort, metallic dies and counter-dies are almost necessary. The die is made in the same manner as the artificial stone die, except that it is poured in investment material instead of stone. This die cannot be used in pressing the tantalum, but is necessary to the fabrication of the counter-die. This investment model is matrixed with moldine and a zinc counter-die poured. The zinc counter-die is then matrixed with moldine, painted with a solution of talc in alcohol, and the die poured in lead.

Pressing the plate.—When the defect is a large one, the layer of plasticine is carefully removed from the corrected model, and placed, outside down, against the tantalum sheet. It should be pressed gently, so that it is in complete contact with the tantalum sheet. In this manner the proper outline of the tantalum plate is established

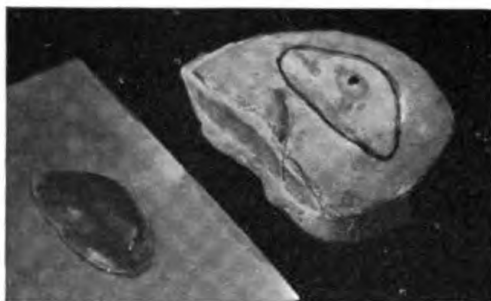


FIGURE 9.—Establishing the outline with wax pattern.

water until it becomes softened, and it is applied to the tantalum sheet in the same manner (fig. 9). After the outline has been established, the tantalum pattern is cut with a pair of plate shears, and is ready for pressing.

The plate is pressed by placing the properly cut sheet of tantalum between the die and counterdie which are then placed in a flask press which is closed until the die and counterdie are in contact all around their peripheries. In large plates several pressings are sometimes necessary, and the press is closed part way, then opened and the tantalum sheet replaced and repressed. The plate has been properly pressed when it can be placed on the original model and remains in contact with the entire penciled outline (fig. 10).

Finishing the plate.—Pairs of small holes are drilled with a No. 35 bur to be used for wiring the plate to the skull. These holes should be $\frac{1}{8}$ inch from the periphery of the plate and $\frac{1}{8}$ inch apart in locations specified by the neurosurgeon. If tantalum screws are to be used for retaining the plate, individual holes large enough to admit the screws, are drilled in the parts of the plate specified. Other holes are drilled, with a No. 38 bur, over the entire surface of the plate so that the holes are about $\frac{1}{2}$ inch apart. These holes allow for drainage through the plate during healing. The rough edges around the holes are eliminated with gold finishing burs and other rough spots and scratches are removed with coarse pumice. A high polish is not desirable, but all rough areas and sharp projections should be removed so that the plate will not irritate the cranial tissues (fig. 11).

After the polishing, the plate should be washed in carbon tetrachloride to remove grease, rinsed

before it is pressed. The plasticine is outlined on the tantalum sheet with a sharp instrument. With a very large, or very deep defect, the combination of wax and plasticine is less likely to cause distortion of the pattern outline than is wax alone. In those cases in which the entire deformity has been corrected with wax, the wax is held in warm



FIGURE 10.—A pressed plate in artificial stone die. Note coathanger wire reinforcement.

with water, and bathed for 10 minuter in dilute nitric acid to remove any splinters of tantalum which may have been pressed into the surface of the plate. Following the acid bath, the plate is again rinsed thoroughly with soap and water, dried carefully with a clean towel to avoid grease and fingerprints, and it is ready to be autoclaved and inserted.

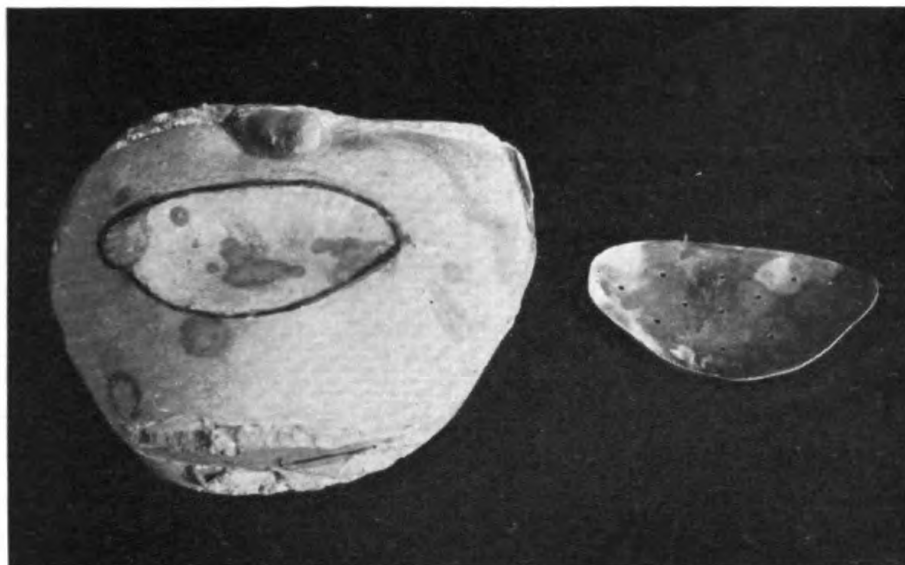


FIGURE 11.—Finished plate.

REFERENCES

1. BURKE, G. L.: Corrosion of metals in tissues; and introduction to tantalum. *Canad. M. A. J.* 43: 125-128, August 1940.
2. CARNEY, H. M.: Experimental study with tantalum. *Proc. Soc. Exper. Biol. & Med.* 51: 147-148, October 1942.
3. CRAIG, W. M.: War wounds of peripheral nerves. *U. S. Nav. M. Bull.* 41: 613-624, May 1943.
4. HORRAX, G.: Panel discussions; treatment of war injuries of skull and brain. *Bull. Am. Coll. Surgeons* 27: 127-131, April 1942. Discussion by Captain F. R. Hook (MC) U. S. N.
5. PUDENZ, R. H.: Repair of cranial defects with tantalum; experimental study. *J. A. M. A.* 121: 478-481, February 13, 1943.

STUDIES ON NEW INSECT REPELLENTS¹

The Chemistry

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During the past few years, the search for new mosquito repellents has gained considerable attention. The work begun by Granett in 1935 has been systematically developed at Rutgers University and the main methods of mosquito rearing and testing as devised by him (1) have been elaborated or to some degree modified. Granett further defined an ideal repellent and specified its essential characteristics (2) which have since been modified only with regard to the duration of effectiveness (3).

In 1942 the armed forces adopted dimethyl phthalate and various standard commercial products, or mixtures of these compounds, as insect repellents, even though it was recognized at that time that they were not entirely satisfactory. Since then, the search for a more nearly perfect repellent has followed two lines of endeavor: (a) To find new repellent chemicals and (b) to prolong the effectiveness of the adopted ones by incorporating them in a wide variety of bases. This process involved a systematic screening procedure of new compounds by the United States Department of Agriculture at Orlando, Florida, and the testing of repellents in various vehicles. The program was organized so that several thousand compounds and their

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derivatives could be rapidly tested and the results summarized by the Insect Control Committee of the National Research Council. This process made current data available to those working on repellents for military use.

The problem of the study of insect repellents is a complex one and only recently have certain criteria been established for critical evaluation. Briefly, these are as follows: (a) The tests must be carried out under constant environmental conditions, preferably those simulating hot tropics, (b) the volunteers making the tests must remain within such an environment at all times since changes in environment tend to prolong the effectiveness of repellents, and (c) the repellents must be tested for toxicity by the Food and Drug Administration of the United States Department of Agriculture. The synthesis of new repellents must entail a correlation of structure with their effectiveness, and synergistic interaction between repellent and solvent must be sought for. Considerable data have been presented in reports (4), (5), (6), (7), (8), (9) to the Bureau of Medicine and Surgery of the Navy Department. Since security classification on these studies has now been removed, three phases of the repellent investigation will be presented briefly. (Studies will be presented in greater detail at a later date.)

It was noted that the protection periods (activity) afforded by mosquito repellents when applied to the skin under simulated tropical

TABLE 1.—*Effect of experimental heat on the mosquito-repellent activity of dimethyl phthalate and NMRI-201 against Aedes aegypti*

Repel- lent	Sub- ject	Arm	Time (in minutes) to first bite					
			Tests without exercise			Tests with exercise		
			Environmental con- ditions— Dry bulb..... Wet bulb.....	80° F. 70° F.	90° F. 70° F.	Environmental con- ditions— Dry bulb..... Wet bulb.....	90° F. 80° F.	90° F. 80° F.
Dimethyl phthalate	F	{R.....		266 (D) ¹	91 (D) ¹		65 (VS) ¹	56 (PS) ¹
		{L.....		261 (D)	81 (D)		66 (VS)	54 (PS)
	G	{R.....		269 (D)	97 (D)		67 (VS)	53 (PS)
		{L.....		265 (D)	80 (D)		65 (VS)	61 (PS)
	P	{R.....		272 (D)	118 (D)		116 (D)	58 (PS)
		{L.....		271 (D)	124 (D)		127 (D)	62 (PS)
		Range.....		261-272	80-124		65-127	53-62
		Average.....		267	99		84	57
NMRI-201	F	{R.....		285 (D) ²	188 (D) ²		142 (VS) ²	165 (PS) ²
		{L.....		289 (D)	185 (D)		155 (VS)	178 (PS)
	G	{R.....		282 (D)	182 (D)		161 (VS)	166 (PS)
		{L.....		277 (D)	179 (D)		146 (VS)	176 (PS)
	P	{R.....		286 (D)	198 (D)		148 (D)	151 (PS)
		{L.....		289 (D)	192 (D)		169 (D)	157 (PS)
		Range.....		277-289	179-198		142-169	151-178
		Average.....		285	187		154	166

¹ Skin condition at time of experiment indicated by D (dryskin), VS (visible sweat), and PS (pooled sweat).

² Same skin conditions as those of dimethyl phthalate.

conditions (90° F. dry bulb, 80° F. wet bulb) were decreased as compared to the action of a repellent used in more moderate conditions (80° F. dry bulb, 70° F. wet bulb). Thus against *Aedes aegypti* (of known density and fixed biting rates) the action of dimethyl phthalate (high protection stock) and NMRI-201 (see p. 1517) had the repellent activity shown in table 1.

Dry heat (90° F. dry bulb, 70° F. wet bulb) produced the most significant decrease in repellent effectiveness (from average of 267 minutes to average of 99 minutes with dimethyl phthalate and from average of 285 minutes to average of 187 minutes with NMRI-201). With the same dry-bulb temperature (90° F.) increasing the humidity (wet bulb 80° F.) produced only a slight additional decrease in repellence. It is presumed that the effects of increasing the humidity were due to the dilution of the repellents by sweat.

It is thus apparent that fixed environmental conditions are necessary for the evaluation of a repellent and the data secured by such a method are valuable to the chemist for the evaluation of molecular changes with reference to functioning groups and the decision of compounds to be preferred.

The early tests also indicated that certain standard commercial repellents could have their protection period enhanced by the addition of relatively nonrepellent solvents. Thus when this repellent was mixed with benzyl alcohol, the following results as shown in table 2 were obtained:

TABLE 2.—Effect of benzyl alcohol on the repellent action of a standard commercial repellent* against *Aedes aegypti* under environmental conditions of 80° F. dry bulb, 70° F. wet bulb

Commercial repellent (parts)	Benzyl alcohol (parts)	Duration of repellent (minutes)	Synergic index	Repellent index
			$\frac{\tau_{\text{mixture}}}{\tau_{\text{sol.}}f + \tau_{\text{solv.}}(1-f)}$	$\frac{\tau_{\text{mixture}}}{\tau_{\text{solute}}}$
1.0	0	95	1.0	1.0
.9	0.1	101	1.15	1.06
.8	.2	251	3.03	2.64
.7	.3	167	2.20	1.76
.6	.4	112	1.60	1.19
.5	.5	110	1.70	1.16
.4	.6	83	1.50	.67
.3	.7	57	1.20	.60
.2	.8	52	1.20	.55
.1	.9	50	1.35	.53
0	1	30	1	.31

*52 separate tests were performed with benzyl alcohol with comparable results.

Results were obtained with other solvents and the effect of these solvents was either to increase the effectiveness (synergism) or to decrease the effectiveness (antagonism).

If adding solvent to pure solute in some specified proportion makes T' mixture greater than T' solute or T' solvent, the practical measure

is one which determines the degree of enhancement by the ratio, where T represents the time of protection in minutes.

$$\frac{T \text{ mixture}}{T \text{ solute}} = \text{Repellent Index (RI)}$$

But it is important to note that this does not take into account the proportions of solvent or solute or the repellent activity of the solvent. It does not disclose the proportionate effectiveness of the ingredients.

It is apparent that some new relationship (equation) must be established. The fraction of solvent and solute can be designated by the symbol (f) and the volume of the solute in a mixture can be referred to as f and the proportion of solvent as $1-f$. And since the effects of both solvent and solute are not necessarily additive and the ratio of the new quantities is an expression of interaction with reference to the proportional repellent periods of the components, the following expression is used:

$$\text{Synergic Index (SI)} = \frac{T \text{ mixture}}{T \text{ solute } (f) + (1-f) \text{ solvent}}$$

The Synergic Index has been found to be the only useful measure in the study of mixtures of repellents. As such it can be related to the Repellent Index as follows:

$$SI = \frac{\frac{T \text{ mixture}}{T \text{ solute}}}{f + (1-f) \frac{T \text{ solvent}}{T \text{ solute}}} = \frac{RI}{f + (1-f) \frac{T \text{ solvent}}{T \text{ solute}}}$$

or the

$$\text{Repellent Index} = (SI) f + (1-f) \frac{T \text{ solvent}}{T \text{ solute}}$$

A synergic index of greater than 1 indicates that a measurable degree of interaction has occurred in the direction of enhancing the repellent action. A value of less than 1 indicates that the opposite is true. From studies such as these it was found that the repellent action of a standard commercial product and dimethyl phthalate could be doubled when diluted with certain selected nonrepellent solvents. However, this increase was not sufficient to attain the period of protection desired in the Tropics.

As a result of extensive experimentation, it was ascertained that organic compounds containing a nucleus consisting of hydrogenated naphthols and hydrogenated diphenyls possessed the potential desirable repellency, and that when these are mixed together or with other solvents, the repellent activity may be materially increased.

Recently, certain of the repellent mixtures herein presented have been tested in tropical areas where high temperatures and large mosquito densities prevailed. The reports received compare favorably with the repellent activity observed at the Naval Medical Research Institute; in many instances, certain of the repellent mixtures were effective for from 8 to 11 hours against *Anopheles albimanus*. It is the purpose of this report to summarize the repellent activity and the methods of preparation of the most effective compounds from the large series synthesized or studied at this Institute. Toxicological studies of these repellents are being carried out and will be reported later. The majority so far appear to have little or no toxicity when applied to the skin.

CHEMISTRY AND METHODS OF PREPARATION

NMRI No. 458.—2-naphthol, 1, 2, 3, 4-tetrahydro, 1-methyl; (*PDB*)² An alkaline solution of 2-naphthol in excess formalin was heated for 2 hours, then acidified to form a precipitate of 1, 1'-methylene, 2-naphthol. This precipitate was heated with a solution of sodium in methanol in an autoclave at 220° C. for 12 hours (10). The product 1-methyl, 2-naphthol was isolated in a 70-percent yield (BP. 134–136° C./1.5 mm.; mp. 110°–111° C.) after recrystallization from petroleum ether. The crystals were hydrogenated to the tetrahydro derivative at 200° C. over copper chromite.

NMRI No. 431.—2-phenyl cyclohexanol (purified); (*NMRI*)². 2-hydroxydiphenyl was added to absolute ethyl alcohol in the presence of Raney nickel. The mixture was subjected to 5,525 pounds pressure of hydrogen at room temperature and then heated to 140°–150° C. until the theoretical amount of hydrogen (5 mols.) had been absorbed. When the reaction was completed (final pressure 2,025 lb.) the apparatus was cooled and the material removed, filtered and the alcohol separated by distillation (11). The crude material was then washed with 5-percent sodium hydroxide solution and the final compound obtained by fractional distillation between 138°–140° C./16 mm.

Certain commercial supplies of 2-phenyl cyclohexanol have been found to contain impurities which may produce dermatitis and affect the mosquito-repellent action. It became necessary to remove these interfering substances in the following manner:

The technical product was washed twice with two volumes of 10-percent NaOH solution, taken up in sufficient quantity of ether for complete solution, and the ether solution washed with water until free

² The symbol *PDB* signifies compounds prepared by Dr. Paul D. Bartlett, Harvard University, and the symbol *NMRI* signifies compounds prepared at the Naval Medical Research Institute.

from alkali. The ether was removed by distillation, and the residue distilled *in vacuo* with an efficient fractionating column. The fraction boiling at 142°–145° C. at 13 mm. Hg. pressure was collected.

The freshly-distilled product consisted of colorless, needle-like crystals and had the following properties:

B. P.	142°–145° C. at 13 mm. Hg
M. P.	43° C. ± 0.002
Specific gravity.	1.0750 ± 0.0002
Solubility.	Insoluble in water, soluble in alcohol and ether

NMRI No. 459.—2-naphthol, 1, 2, 3, 4-tetrahydro, 1-ethyl (*PDB*). 2-naphthol was dissolved in cold NaOH solution and acetylated to give a 91-percent yield. The acetate was rearranged to 1-aceto, 2-naphthol in a 60-percent yield under the influence of aluminum chloride (*12*). The ketophenol in ethanol was hydrogenated over copper chromite for 10 hours at 145°–205° C. The product was an uncrystallized viscous liquid with a yield of 40 percent (BP. 92°–100° C./0.3 mm.). Musser and Adkins (*13*) reduced 1-aceto, 2-naphthol in two steps and their product melted at 88°–89° C.; the product prepared was contaminated with decahydro material which may account for the failure to crystallize.

NMRI No. 402.—di(2-naphthol, 1,2,3,4-tetrahydro) mixed esters of oxalic acid; (*NMRI*). A mol. of 2-naphthol, 1,2,3,4-tetrahydro was reacted with an excess of oxalyl chloride at a temperature of 15° C. (ice bath). When the vigor of the reaction subsided, the vessel and contents were heated at 60° C. for 2 hours. The resulting white mass was recrystallized from 95-percent ethanol resulting in a white crystalline product (mp. 60° C.).

NMRI No. 412.—2-naphthol, 1,2,3,4-tetrahydro, mixed acetyl glycine esters (120°–139° C./15 mm.); (*NMRI*). Under constant stirring, acetyl glycine in excess and 2 naphthol, 1,2,3,4-tetrahydro were esterified with anhydrous HCl (or concentrated H₂SO₄) for 4 hours. The temperature of the reaction was kept at 50° C. The viscous liquid was poured in water, washed, neutralized, and extracted with ether. The ether was evaporated and the remaining liquid fraction was distilled and collected (120°–139° C./15 mm.). The solid residue was recrystallized from alcohol (mp. 89°–90° C.) which proved to be the acetyl glycine ester. Recent investigations indicate the distillate contains the effective repellents 1.2 dihydro naphthalene and 1.4 dihydro naphthalene, and that the fraction containing the acetyl glycine ester (identified as such) is an effective repellent.

NMRI No. 460.—2-naphthol, 1,2,3,4-tetrahydro, 1-methyl acetate; (*PBD*). (See preparation of *NMRI No. 458*, p. 1510.) The product is acetylated in the presence of pyridine with 98-percent yield (BP. 147°–150° C./15 mm.).

NMRI No. 436.—2-naphthol, 1,2,3,4-tetrahydro, 1-methoxy; (*PDB*). 1,4-dihydronaphthalene obtained in the preparation of sodium-methylaniline (14) was isomerized to 1,2-dihydronaphthalene by refluxing in a solution of sodium isoamyloxide in isoamyl alcohol with a yield of 72 percent (BP. 105°–108° C./30 mm.). The bromhydrin of the olefin was made by dropping an equivalent of bromine into a stirred hot-water suspension of the dihydro compound. The bromhydrin crystallized and was recrystallized from 1–1 solution of benzene and 70–90 percent ligroin; yield 69 percent (mp. 110° C.). The bromhydrin was converted to the oxide as an ether solution treated in the cold with KOH in methanol. The crude oxide was then dissolved in twofold excess alcoholic sodium methoxide and allowed to stand for ten hours, refluxed, water washed, and distilled, resulting in 1-methoxy-2-hydroxytetralin. This produce when hydrogenated yields the naphthol.

NMRI No. 462.—2-naphthol, 1,2,3,4-tetrahydro, monochloro; (*NMRI*), 2-naphthol, 1,2,3,4-tetrahydro was treated with acetic anhydride, and the resulting 2-naphthol, 1,2,3,4-tetrahydro acetate was dissolved in CCl₄, then placed in a reflux apparatus with stirrer, containing FeCl₃ as catalyst, and subjected to Cl₂ aeration for 30 minutes. Heat was then applied and the temperature of the solution maintained at 75° C. and chlorination continued for 3 hours. The product was washed several times with water and then hydrolyzed for 3 hours with 15-percent NaOH solution. The compound was ether extracted, washed, and dried over sodium sulfate, the ether removed *in vacuo*, the residue distilled and the fraction at 134°–136° C. at 10 mm. used.

NMRI No. 421.—1-naphthol, decahydro (cis) (100°–110° C./16 mm.); (*NMRI*). 1,5-naphthalene diol in absolute alcohol in the presence of catalyst (Raney nickel) was subjected to 5,000 pounds hydrogen initial pressure and the temperature maintained at 175° C. until the theoretical amount of hydrogen was absorbed (final pressure 1,800 pounds). The catalyst was removed, alcohol distilled off and the 100°–150° C./15 mm. fraction collected, alpha decalols being the chief products (15).

NMRI No. 432.—2-naphthol, 1,2,3,4-tetrahydro (purified); (*NMRI*). Betanaphthol was dissolved in absolute ethyl alcohol and the mixture subjected to 5,000 pounds pressure of hydrogen in a hydrogenator at room temperature. The hydrogenator was then heated to 190° C. and rotated (16). The reaction was continued until the theoretical amount of hydrogen (4 mols.) was absorbed (3,400 pounds final pressure) and then cooled. The compound was then removed, the catalyst filtered and the alcohol separated by distillation. The pure compound was then obtained by fractional distillation between 135°–140° C./15 mm.

NMRI No. 408.—2-naphthol, 1, 2, 3, 4-tetrahydro glycollic ether (136°–140° C./14 mm.); (*NMRI*). 2-naphthol, 1, 2, 3, 4-tetrahydro was reacted with ethylene oxide (excess) for 6 hours at 100° C. in a bomb, then cooled and the product taken up in ether and washed in water. The ether was removed *in vacuo*, the residue distilled, and the fraction, boiling at 136°–140° C./14 mm., was collected.

NMRI No. 429.—2-phenyl cyclohexanol acetyl glycine ester; (*NMRI*). 2-phenyl cyclohexanol was treated as described in the synthesis of *NMRI No. 412* (see p. 1511) using anhydrous HCl. The possibility of contamination with dihydro-phenyl-cyclohexanol cannot be excluded.

NMRI No. 461.—2-naphthol, 1, 2, 3, 4-tetrahydro, 8-mononitro, 2-acetate; (*NMRI*). 200 ml. H₂SO₄ were cooled to 0° C. and 0.75 mol. of 2-naphthol 1, 2, 3, 4-tetrahydro was added with constant stirring and again cooled to 0°–10° C. Then under vigorous stirring, 128 ml. of nitrating mixture (50% HNO₃ and 50% H₂SO₄) are added gradually. During this reaction (requiring approximately 60 minutes) the mixture should be kept from 5°–15° C. After reacting, stirring is continued for 90 minutes more and the mixture then poured on cracked ice, the water layer removed, rewashed until neutral, extracted with ether evaporated, and distilled. The fraction collected was at 130°–133° C./10 mm.

NMRI No. 441.—2-naphthol, 1, 2, 3, 4-tetrahydro propionate; (*PDB*). 2-naphthol, 1, 2, 3, 4-tetrahydro was reacted with propionic anhydride, washed with ether, and distilled.

NMRI No. 427.—2-naphthol, 1, 2, 3, 4-tetrahydro (specially distilled); (*NMRI* procedure). This compound was washed with two volumes of 10-percent NaOH solution taken up in ether as in the synthesis of *NMRI No. 431*, and then washed with water until free from alkali. The compound, after removal of the ether *in vacuo*, was further purified by distillation using an efficient fractionating column to eliminate any phenolic contaminants not removed by alkali extraction. The component distilling at 134°–136° C. at 13 mm. was collected.

The freshly distilled fraction is a colorless, viscous liquid with the following properties:

Refractive index.....	1.5624—0.0002 at 23.4° C.
Specific gravity.....	1.0716—0.0002
B. P.....	134°–136° C. at 13 mm.
Solubility.....	Insoluble in water, soluble in alcohol and ether.

Beta tetralol (2-naphthol, 1,2,3,4-tetrahydro) was prepared according to the method described and immediately following vacuum distillation was placed under an atmosphere of CO₂. A stock supply kept under this gas does not undergo color change. In order to measure oxygen uptake by beta tetralol, samples were placed in calibrated

Warburg vessels containing known quantities of the compound and oxygen and shaken in a water bath at various constant temperatures. At definite time intervals the oxygen utilization was noted and the sample removed for paired tests against *Aedes aegypti*.

Of the changes that occur with the oxidation of the beta tetralol molecule, polymerization with the formation of hydroperoxides seemed the more prominent. These considerations were brought to the attention of Dr. P. D. Bartlett who undertook to prepare oxidized beta tetralol with a known peroxide content. It was the experimental plan to mix such a compound in various concentrations with freshly-distilled beta tetralol and to determine if mosquito-repellent action paralleled the changes in peroxide content when compared to oxidized beta tetralol. Bartlett prepared "oxidized" beta tetralol by shaking the compound (99 percent purity) in an oxygen atmosphere irradiated with ultra-violet light at 60° C. In 127 hours the compound absorbed 0.081 equivalent of oxygen and contained 1.7 percent hydroperoxide groups by iodometric analysis. A sample of this compound of known peroxide content was then diluted with unoxidized beta tetralol and tested for repellency against mosquitoes.

TESTS OF REPELLENT ACTION OF COMPOUNDS

In order to ascertain the effects of antioxidants on the oxidation of beta tetralol, thiourea, hydroquinone, and quinhydrone were added to samples of the partially oxidized beta oxidized beta tetralol (44 hours in air) and their mosquito-repellent action determined.

When 3 ml. samples of freshly-distilled beta tetralol are placed in oxygen atmosphere in Warburg vessels and shaken at 42° C. a definite uptake of oxygen occurs. Corrections for changes in atmospheric conditions can be made by the use of blank vessels containing the gas. The results of paired tests against *Aedes aegypti* are summarized in table form as follows:

Vessel No.	Time	Pressure changes	Uptake O ₂	Equivalents of O ₂ per mol. beta tetralol × 10 ⁻³	Repellent action against <i>Aedes aegypti</i> , 90° F. dry bulb, 80° F. wet bulb
	<i>Hours</i>	<i>Mm.</i>	<i>Cu. mm.</i>		<i>Minutes</i>
1	2	103	142.0	1.070	147
13	3	103	144.5	1.185	167
4	10	129	192.1	1.450	158
17	21	196	264.4	1.991	132

During these tests freshly-distilled beta tetralol (unoxidized) had a protection period of 127 minutes. It would thus appear from these data that a certain degree of oxidation enhances the repellent action of beta tetralol and that such a peak is reached after the compound has

been subjected to an atmosphere of oxygen for three hours at 42° C. A slight decrease of repellent action is noted when such conditions are maintained for 10 hours or more. Similar data were obtained when the reactions were carried out at 37° C.

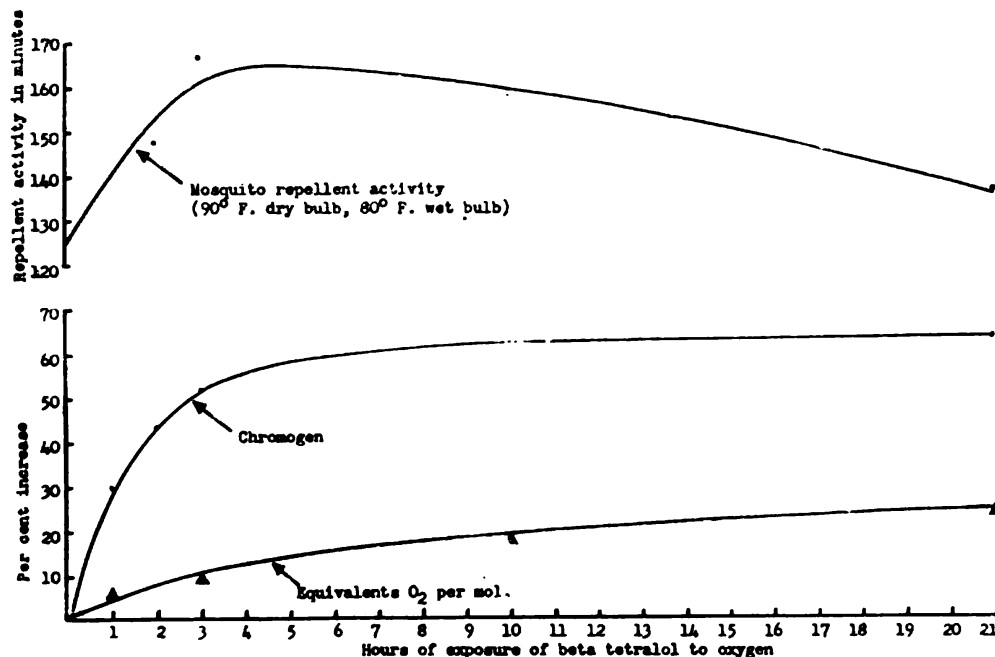


FIGURE 1.—Comparison between color development and oxidation of beta tetralol and its mosquito-repellent action.

Since continued oxidation and color development of beta tetralol inhibits its mosquito-repellent action (fig. 1) it became necessary to determine the effects of antioxidants on this process. Freshly-distilled beta tetralol and partially-oxidized beta tetralol (1.070 equivalents O_2 per mol. tetralol) were compared as mosquito repellents. Thiourea, hydroquinone, and quinhydrone were then added to samples of partially-oxidized beta tetralol. With the exception of the freshly-distilled unoxidized tetralol all of the samples were then exposed to air at 37° C. for 44 hours. The results are summarized in table form as follows:

Oxidation of beta tetralol		Percent total added material	Mosquito-repellent duration, 90° F. dry bulb, 80° F. wet bulb
Original exposure to O_2	Subsequent exposure to air at 37° C.		
Hours	Hours	By weight	Minutes
0	0	None.....	119
2	44	None.....	139
2	44	1.6 hydroquinone.....	177
2	44	1.6 thiourea.....	174
2	44	1.6 quinhydrone.....	131

These data confirm the previous finding that partial oxidation of beta tetralol improves its mosquito-repellent action (139 minutes versus 119 minutes). It is also evident that hydroquinone and thiourea increase the repellent activity of the compound. Such a change may be due in part to synergism and to the oxygen-acceptor action of hydroquinone or the antioxidant effect of thiourea. Quinhydrone was less effective.

If the action of hydroquinone and thiourea was related to the sparing action alone of oxidation of beta tetralol, the mosquito-repellent values presumably should have been approximately 139 minutes. But since the values were considerably greater, it was apparent that synergism was present regardless of inhibition of beta-tetralol oxidation. In order to test this assumption fresh, unoxidized beta tetralol was mixed with hydroquinone in varying proportions and the following repellent activities observed:

Unoxidized beta tetralol (total weight Gm.)	Hydroquinone		Repellent time, 90° F. dry bulb, 80° F. wet bulb
	Mg.	Percent of total	
3	6	0.2	<i>Minutes</i> 131
3	12	.4	125
3	24	.8	174
3	36	1.2	162

The solutions were tested immediately after mixing in order to eliminate the effects of oxidation. From such data it can be inferred that synergism had occurred relative to mosquito-repellent action. But the use of thiourea and hydroquinone with beta tetralol was disappointing since in five days all of the samples containing these antioxidants had lost their enhanced mosquito-repellent activity. At the end of this time the repellent duration had returned to 119–139 minutes in simulated tropical conditions against *Aedes aegypti*. Furthermore, during this time the color of the solutions had deepened considerably.

To test in another way the effect of oxidation of beta tetralol on its mosquito-repellent action, oxidized beta tetralol of known hydroperoxide value was tested against mosquitoes and also mixed with freshly-distilled beta tetralol to determine interaction effect. The results are summarized as follows:

Amount un-oxidized beta tetralol	Amount oxidized beta tetralol	Hydroperoxide content percent of total	Repellent activity, 90° F. dry bulb, 80° F. wet bulb
<i>Ml.</i>	<i>Ml.</i>		<i>Minutes</i>
3.0	None	None	116
2.7	0.3	0.17	144
2.4	.6	.34	165
2.1	.9	.51	129
1.5	2.25	1.27	119
None	3.0	1.70	113

Unoxidized beta tetralol protected against mosquitoes for 116 minutes and its repellent activity was enhanced as the hydroperoxide content was increased (0.34 percent of total) at which concentration it repelled for 165 minutes. This compares favorably with a period of oxidation under O_2 for 3 hours. From the curve of oxidation (fig. 1) it is to be noted that maximum oxygen utilization took place in the first 4 hours. It is not difficult therefore to assume that the beta tetralol hydroperoxide content can be estimated from its mosquito-repellent action. From the data the ideal peroxide content for beta tetralol mosquito-repellent effectiveness should be approximately 0.34 percent.

The same phenomenon took place in the mosquito repellent *NMRI-201* where beta tetralol is mixed with 2-phenyl cyclohexanol. The reaction may be inhibited slightly by the phenyl cyclohexanol. Thus, when fresh beta tetralol is used in *NMRI-201*, the repellent activity under tropical conditions is 160 minutes, with partially oxidized beta tetralol 178 minutes, and with well-oxidized beta tetralol 159 minutes. These findings further bear out the similarity of fresh beta tetralol to well-oxidized beta tetralol in mosquito-repellent action as compared to degrees of synergism. The addition of hydroquinone to *NMRI-201* markedly affects the 2-phenyl cyclohexanol fraction by reducing the repellent activity to 19 minutes. This is further substantiated by the finding that a small amount of hydroquinone (39 mg.) inhibited the action of 2-phenyl cyclohexanol alone from an original value of 157 to 96 minutes. Thiourea, however, protected *NMRI-201* for a period of 7 days but eventually lost its effect.

In order to determine the effectiveness of *NMRI-201* against a variety of insects, samples were sent to several investigators in the United States and Central America for field testing. The first tests were conducted in the jungles near San Juan del Gozo, El Salvador, against the nocturnal mosquitoes, *Anopheles albimanus* and *A. pseudo-punctipennis*, and the diurnal species, *Aedes taeniorhynchus*, *A. aegypti*, and *A. euplocamus*. In all of these jungle tests four drops of repellent were applied to the face and neck, four drops to each arm, and six drops to each leg. Four men used *NMRI-201* while the fifth,

serving as a control subject, applied 2-phenyl cyclohexanol. At night the control subject received the first bite 3 hours after applying the repellent. One person using *NMRI-201* was bitten 11 hours after treatment, but the others were still protected when the tests were terminated at the end of 13 hours. During the day *NMRI-201* repelled the *Aedes* spp. for 3½ hours. Dimethyl phthalate had lasted less than 1 hour and a standard commercial repellent 1½ hours against these same species in Managua, Nicaragua. At Jaltepec Island, El Salvador, *Aedes taeniorhynchus* and *Culicoides* spp. were repelled for 5 hours and, in an incompleting test, *Anopheles albimanus* and *A. pseudopunctipennis* for 7 hours by *NMRI-201*.

Similar reports from the United Fruit Company at Manila, Costa Rica, confirm the effectiveness of *NMRI-201* against *A. albimanus*; at Almirante, Panama, incompleting tests indicate that this compound repels *Mansonia titillans* for more than 5 hours. Other studies in Central America disclose that this preparation prevents the attachment of mites (chiggers) for at least 8 hours and repels sand-flies for 3½ hours. Similar protection from chiggers has been observed at Camp Lejeune, North Carolina, and in central Georgia.

While these field tests were being conducted, the Food and Drug Administration, Federal Security Agency, studied the toxicity of *NMRI-201* and of beta tetralol. They found that, although acute toxicity tests were generally favorable, *NMRI-201* produced some toxicological manifestations upon continued administration to rabbits. Since the same results had been obtained with beta tetralol alone, it was apparent that this compound was the toxic fraction of the preparation. However, in view of the extended effectiveness of the repellent, the toxicologists concluded that *NMRI-201* must be considered for adoption unless primary irritation was of high incidence (18). From the data on the laboratory and field tests, primary irritation to the skin was noted in 6 of the 59 subjects.

TABLE 3.—Incidence of skin irritation by the repellent *NMRI-201*

Location of tests	Number of subjects	Skin response			
		None	Tingling sensation	Warm sensation	Erythema
<i>NMRI</i>	10	8	1	1	0
Palmar, Costa Rica.....	2	1	0	0	1
Manila, Costa Rica.....	25	23	1	1	0
Good Hope, Costa Rica.....	1	0	1	0	0
Almirante, Panama.....	13	13	0	0	0
Georgia.....	1	1	0	0	0
San Juan del Gozo, El Salvador.....	4	4	0	0	0
Jaltepec Island, El Salvador.....	2	2	0	0	0
Managua, Nicaragua.....	1	1	0	0	0

In view of these findings a substitute for beta tetralol was obviously needed. A series of other naphthol derivatives was synthesized and tested in the laboratory. While most of these compounds had repellent properties and many of them produced no skin irritation, they could not be used because they were either too costly to make or were not feasible for large-scale production. Modifications of 2-phenyl cyclohexanol were then studied. None of the derivatives was as effective as the parent compound, but a mixture, *NMRI-448*, (see table 6) of 30-percent 2-cyclohexyl cyclohexanol and 70-percent 2-phenyl cyclohexanol (by volume) was more effective than *NMRI-201*. Further field tests in the Tropics have verified these laboratory findings.

TABLE 4.—Comparison of the repellent activity of *NMRI-448* and *NMRI-201*

Species repelled	Average period (in hours) of complete protection afforded by	
	<i>NMRI-448</i>	<i>NMRI-201</i>
Insects:		
<i>Aedes aegypti</i>	5	3.5
<i>A. taeniorhynchus</i>	5-6	3.5-4
<i>A. euplocamus</i>		3.5
<i>A. augustitatus</i>	10+	
<i>Anopheles albimanus</i>	11+	11+
<i>A. darlingi</i>	9+	
<i>A. pseudopunctipennis</i>	10+	11+
<i>Psorophora ferox</i>	10+	
<i>Uranotaenia spp.</i>	10+	
"Bed bugs".....	12+	12+
"Sandflies".....	4+	3-7
Mites: "Chiggers".....	8+	8+

Plus (+) indicates that tests were interrupted.

No cases of skin irritation have been observed from the use of *NMRI-448*, but so far relatively few subjects have used it. Toxicological studies on this preparation by the Food and Drug Administration are still incomplete, but their experiments in their present stage of progress indicate the likelihood that the compound will be acceptable (19).

Special field studies have been recently instituted using *NMRI-448* as a repellent and recommendation must await reports dealing with effectiveness and toxicity of the compounds resulting from large-scale observations.

Other compounds tested.—Other repellent chemicals tested did not have the effective periods of protection against *Aedes aegypti* under the environmental conditions of 90° F. dry bulb and 80° F. wet bulb. Their syntheses furthermore were performed elsewhere and information regarding these compounds can be secured through the Insect Control Committee of the National Research Council.

REPELLENT EFFECTIVENESS

The results of repellent tests with individual compounds and with mixtures yielding the highest synergic interaction are expressed, for purposes of simplicity, in tabular form in tables 5 and 6.

TABLE 5.—*Final selection of compounds which repel Aedes aegypti for longer than 120 minutes at NMRI at environmental temperature of 90° F. dry bulb, 80° F. wet bulb*

NMRI sample number	Repellent chemicals	Number of tests	Average time to first bite (minutes)
458	2-naphthol, 1, 2, 3, 4-tetrahydro, 1-methyl.....	3	259
431	2-phenyl cyclohexanol, purified.....	5	239
459	2-naphthol, 1, 2, 3, 4-tetrahydro, 1-ethyl.....	3	230
402	di(2-naphthol, 1, 2, 3, 4-tetrahydro) ester of oxalic acid.....	3	226
412	a mixture of 2-naphthol, 1, 2, 3, 4-tetrahydro acetyl glycine ester (120°-139° C.; 15 mm.) and dihydronaphthalenes (120°-139° C.; 15 mm.).....	7	223
460	2-naphthol, 1, 2, 3, 4-tetrahydro, 1-methyl, acetate.....	3	219
436	2-naphthol, 1, 2, 3, 4-tetrahydro, 1-methoxy.....	5	215
462	2-naphthol, 1, 2, 3, 4-tetrahydro, monochloro.....	4	201
421	1-naphthol, decahydro (cis) (100°-110° C., 16 mm.).....	3	198
432	2-naphthol, 1, 2, 3, 4-tetrahydro (purified).....	3	197
408	2-naphthol, 1, 2, 3, 4-tetrahydro glycollic ether (136°-140° C., 14 mm.).....	3	186
429	2-phenyl cyclohexanol acetyl glycine ester.....	4	186
461	2-naphthol, 1, 2, 3, 4-tetrahydro, 8-mononitro, acetate.....	4	178
441	2-naphthol, 1, 2, 3, 4-tetrahydro propionate.....	6	176

	Number of tests	Average time to first bite (minutes)
Control tests:		
Dimethyl phthalate.....	115	63
A standard commercial repellent.....	54	98

TABLE 6.—*NMRI mixtures of compounds which repel Aedes aegypti for longer than 240 minutes (4 hours) at environmental temperatures of 90° F. dry bulb, 80° F. wet bulb**

NMRI	Repellent chemicals	Percent (vol.) of each	Number of tests	Average time to first bite (minutes)
407	2-phenyl cyclohexanol (washed).....	70		
	2-naphthol, 1, 2, 3, 4-tetrahydro, acetyl glycine ester and dihydro naphthalenes.....	30	3	322
406	2-phenyl cyclohexanol (washed).....	70		
	2-naphthol, 1, 2, 3, 4-tetrahydro, glycollic ether (crude).....	30	3	293
448	2-phenyl cyclohexanol (washed).....	70		
	2-cyclohexyl cyclohexanol (washed).....	30	6	289
403	2-phenyl cyclohexanol (washed).....	70		
	di(2-naphthol, 1, 2, 3, 4-tetrahydro ester of oxalic acid.....	30	3	280
465	2-phenyl cyclohexanol (washed).....	70		
	2-naphthol, 1, 2, 3, 4-tetrahydro, 1-methyl.....	30	3	279
464	2-phenyl cyclohexanol (washed).....	70		
	2-naphthol, 1, 2, 3, 4-tetrahydro, 1-methyl, acetate.....	30	3	274
424	2-phenyl cyclohexanol (washed).....	70		
	2-naphthol, 1, 2, 3, 4-tetrahydro acetyl glycine ester (120°-139° C., 15 mm.) and dihydro naphthalenes.....	30	4	272
466	2-phenyl cyclohexanol (washed).....	70		
	2-naphthol, 1, 2, 3, 4-tetrahydro, 1-ethyl.....	30	3	272
455	2-phenyl cyclohexanol (washed).....	70		
	O-3916 Orlando (USDA).....	30	4	257
201	2-naphthol, 1, 2, 3, 4-tetrahydro (washed).....	30	16	255
	2-phenyl cyclohexanol (washed).....	70		
422	2-phenyl cyclohexanol (washed).....	50		
	2-naphthol, decahydro, trans.....	25		
	Ethyl alcohol.....	25	4	246

*These compounds are those from a large series tested in which other derivatives and commercially available repellents were used. None excepting those listed had repellent activity for greater than 240 minutes.

Synergism exists when the majority of the naphthol derivatives and hydrogenated diphenyls are mixed with ethyl, benzyl, and certain other alcohols. So far, the repellents are primarily effective against mosquitoes as indicated by both field trials and laboratory tests; some appear to be effective against red mites, certain flies, and gnats but the repellent activity is reduced somewhat against the latter.

SUMMARY

1. Studies of insect-repellent chemicals at the U. S. Naval Medical Research Institute have revealed that certain hydrogenated naphthol derivatives and hydrogenated diphenyls are more effective than currently-used repellents.

2. The mixing of these new repellent chemicals with 2-phenyl cyclohexanol results in a prolongation of the repellency as a result of synergistic interaction.

3. The methods of synthesis of the compounds are reported and the repellent effectiveness against *Aedes aegypti* tabulated.

4. Toxicological studies remain to be done on a number of these compounds before their general use as repellents can be recommended.

REFERENCES

1. GRANETT, P.: The development of a practical mosquito repellent. Proc. 27th Annual Meeting of the New Jersey Mosquito Extermination Association, 20-22 March 1940.
2. GRANETT, P. and HAYNES, H. L.: Improved methods of rearing *Aedes aegypti* mosquitoes for use in repellent studies. Proc. 31st Annual Meeting of the New Jersey Mosquito Extermination Association, 15-17 March 1944.
3. Report of joint decision (Army and Navy) reached at meeting, report of Insect Control Committee, National Research Council, 26 June 1945.
4. PIJOAN, M. and JACHOWSKI, L. A., JR.: A method of evaluating synergistic or antagonistic action of solvents on mosquito repellents; Report No. 2, U. S. Naval Medical Research Institute, 12 January 1945.
5. JACHOWSKI, L. A. JR., PIJOAN, M., BLODGETT, W. E., and GERJOVICH, H. J.: Summary of investigations on mosquito repellents at the Naval Medical Research Institute; Report No. 3, Naval Medical Research Institute, 12 May 1945.
6. PIJOAN, M., JACHOWSKI, L. A., JR., and GERJOVICH, H. J.: A mixture of two new mosquito-repellent chemicals effective on sweating skin; Report No. 4, Naval Medical Research Institute, 8 June 1945.
7. PIJOAN, M., JACHOWSKI, L. A., JR., GERJOVICH, H. J., and KOZLOFF, L. M.: The oxidation of 1,2,3,4-tetrahydro beta naphthol in relation to mosquito-repellent action; Report No. 5, Naval Medical Research Institute, 8 June 1945.
8. JACHOWSKI, L. A., JR. and PIJOAN, M.: Note dealing with the effect of certain simulated tropical conditions on the activity of two mosquito repellents; Report No. 6, Naval Medical Research Institute, 25 August 1945.
9. GERJOVICH, H. J. and HOPWOOD, M. L.: Directions for purification of commercial grade compounds for the insect repellent NMRI 201; Report No. 7, Naval Medical Research Institute, 25 August 1945.

10. CORNFORTH, J. W., CORNFORTH, MRS. R. H., and ROBINSON, SIR R.: Nuclear methylation of phenols by means of methanolic sodium methoxide. *J. Chem. Soc., London*, 682-684, November 1942.
11. PRICE, C. C. and KARABINOS, J. V.: Dehydration of *cis*- and *trans*-2-phenyl-cyclohexanols, *J. Am. Chem. Soc.* 62: 1159-1163, May 1940.
12. FRIES, K.: Zur Kenntnis der Aceto-naphthole. *Ber. D. Deutsch. Chem. Gesellsch.*, 54: 709-714, 9 April 1921.
13. MUSSER, D. M. and ADKINS, H.: Selective hydrogenation of derivatives of naphthalene and diphenyl. *J. Am. Chem. Soc.* 60: 664-669, March 1938.
14. ZIEGLER, VON K., JAKOB, L., WOLFFTHAN, N., and WENZ, A.: Die ersten Einwirkungsprodukte von Alkalimetallen auf Butadiene. *Liebigs Ann. der chem.* 511: 64-88, 4 June 1934.
15. HUDSON, B. J. F. and ROBINSON, SIR R.: Decalin-1:5-dione and 2:28-diketodicyclopentyl. *J. Chem. Soc., London*, 691-693, November 1942.
16. ADKINS, H. and REID, W. A.: Catalytic dehydrogenation of tetralin and 1,2,3,4-tetrahydro-naphthol-2 in the liquid phase. *J. Am. Chem. Soc.* 63: 741-744, March 1941.
17. BAMBERGER, E. and L. LÖTTER, W.: Ueber allyclisches B-tetrahydronaphthol und Secundäre Ringalkohole. *Ber. D. Deutsch. Chem. Gesellsch.*, 23: 197-213, January 1890.
18. CALVERY, H. O.: Committee of Medical Research, Office of Scientific Research and Development Bimonthly Report, National Research Council, 30 September 1945.
19. Letter to Lt. Comdr. M. Pijoan, U. S. N. R. from Dr. J. H. Draize with information on the toxicity of NMRI-448, 28 February 1946.

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CYTOTOXIC PROPERTY OF MOUSE CANCER ANTISERUM

Authors' conclusions.—An immune serum prepared in rabbits against the mouse mammary carcinoma milk factor, or Bittner virus, when mixed with cancer cells for a period of 6 hours completely inhibits their growth so that transplant tumors do not develop. Control tumors developed after similar treatment of tumor cells with serum from normal rabbits and with serum from rabbits immunized with normal lactating mouse breast tissue.—GREEN, R. G.: Cytotoxic property of mouse cancer antiserum. *Pro. Soc. Exper. Biol. & Med.* 61: 113-114, February 1946.

AN ACHIEVEMENT OF NAVY PEACE-TIME MEDICINE

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So many people have forgotten the crusade for health carried on in Haiti by the Navy's Medical Department for almost a generation between World Wars I and II that it is appropriate to record briefly that achievement of Navy peacetime medicine. October 1, 1946, marks the thirtieth anniversary of an important date in naval medical annals—the official beginning of La Service Nationale d'Hygiene Publique d'Haiti, The National Public Health Service of Haiti.

During 15 years at the helm of public health in Haiti, Navy doctors gained some definite achievements, and the achievements attained have been maintained since the Public Health Service was returned to Haitian control on 1 October 1931. The principal achievements were:

1. Organization of a nationwide system of public health where no such organization had existed prior to 1915.
2. Development of two well-ordered medical centers at Port au Prince and Cape Haitien, and establishment of 10 general and 2 special hospitals in public-health districts.
3. Establishment of a national clinic service reaching into every community of the republic, with 17 city clinics and 153 rural and mountain clinics.
4. Organization for a frontal assault on the endemic plagues of malaria, syphilis, and yaws.
5. Organization of 10 sanitation districts, controlling 10 urban and 53 rural sanitation areas.
6. Establishment of a National School of Medicine and a School of Nursing for the training of Haitian physicians, dentists, pharmacists, nurses, and midwives. Through collaboration of the Rockefeller Foundation and allocation of funds, many medical scholarships have been granted to Haitian physicians in American, Canadian, and European universities.

That these accomplishments were established upon a firm and enduring foundation is witnessed by the fact that after the Americans relinquished control, the National Public Health Service of Haiti has continued the far-flung program under three continuing Directors

General. Dr. Rulx Leon, presently the Consul General of Haiti at New York City, reports the following averages, among others, during the past 4 years, all of which have been war years with limitations on gasoline and other facilities in Haiti as in the rest of the world:

Five hundred thousand clinic consultations; 13,000 hospitalizations; 45,000 injections of neosalvarsan and 350,000 of bismosal; 90,000 spirocide treatments; 1,900 major surgical operations; 6,000 minor operations; 90,000 laboratory examinations; 22,000 children of school and preschool age given annual clinic care; 2,000 aged and infirm sheltered and cared for in 8 welfare homes to which civil employees of the government contributed a portion of their salaries.

The National Public Health Service of Haiti was the Navy's crusade for health in the little island republic of the West Indies. When American naval forces occupied the island in 1915, the officers of the Medical Department immediately instituted public health and sanitation measures under the military occupation. On 16 September 1915 a treaty was negotiated between the United States and Haiti which was ratified 3 May 1916. By Article XIII of this Haitian-American covenant, the American Government was authorized to appoint a Sanitary Engineer for the Republic of Haiti.

Accordingly, a leading naval sanitarian, Commander N. T. McLean (MC), United States Navy, was appointed in this capacity on 21 September 1916, with instructions to organize the functions of his office. The department was officially established by the Government of Haiti on 1 October 1916, when Commander McLean took over from the military occupation the pertinent duties and prerogatives.

On 26 February 1919, President Dartiguenave promulgated the law establishing the National Public Health Service of the Republic of Haiti. On 24 October 1927 the official title of Sanitary Engineer was changed by law to that of Director General. On 1 October 1931, by special accord between the United States and Haiti, American naval medical personnel were withdrawn and the Public Health Service was completely Haitianized. On that date Capt. M. A. Stuart (MC), United States Navy, vacated the office of Director General in favor of Dr. Rulx Leon, a leading Haitian physician who had dedicated his professional career to the field of public health.

From its original establishment until August 1945, when Dr. Jules Thébaud was in office, there were 6 naval medical officers and 3 Haitian physicians who served in the capacity of Sanitary Engineer of Haiti or Director General of the National Public Health Service. Their photographs are reproduced in the accompanying panels and the periods of their service were as follows:

Commander Norman T. McLean (MC), U. S. Navy, 21 September 1916 to August 1920. First Sanitary Engineer of Haiti.

Lt. Comdr. James P. Haynes (MC), U. S. Navy, 9 August 1920 to 28 October 1920 and 31 May 1923 to 1 June 1924. Second naval medical officer to hold the office of Sanitary Engineer of Haiti.

Lt. Comdr. James M. Minter (MC), U. S. Navy, 28 October 1920 to 31 May 1923. Third naval medical officer to hold the office of Sanitary Engineer of Haiti.

Commander Charles St. J. Butler (MC), U. S. Navy, 1 June 1924 to 25 April 1927. Fourth naval medical officer to hold the office of Sanitary Engineer of Haiti.

Commander Kent C. Melhorn (MC), U. S. Navy, 25 April 1927 to 6 August 1930. Fifth naval medical officer to serve as Sanitary Engineer of Haiti and the first to serve as Director General of the National Public Health Service of Haiti.

Capt. Montgomery A. Stuart (MC), U. S. Navy, 6 August 1930 to 1 October 1931. Sixth and last naval medical officer to serve as Sanitary Engineer or Director General. On 1 October 1931 he became Director of the American Scientific Mission to Haiti.

Dr. Rulx Leon, October 1931 to May 1941. First Haitian physician to hold the office of Director General of the National Public Health Service of Haiti and seventh in the office of Sanitary Engineer or Director General.

Dr. Louis Hippolyte, May 1941 to February 1942. Second Haitian physician to hold the office of Director General of the National Public Health Service of Haiti and eighth in the office of Sanitary Engineer or Director General.

Dr. Jules Thébaud, February 1942 to August 1945. Third Haitian physician to hold the office of Director General of the National Public Health Service of Haiti and ninth in succession of Sanitary Engineers or Directors General.



—Underwood & Underwood Photo.

Commander Norman T. McLean (MC),
U. S. N.



—Underwood & Underwood Photo.

Lt. Comdr. James P. Haynes (MC),
U. S. N.



—Photo by Gibson Studios, Chicago.

Rear Admiral James M. Minter (MC),
U. S. N.



—Harris & Ewing Photo.

Read Admiral Charles St. J. Butler
(MC), U. S. N.



—Official U. S. Navy Photo.

Read Admiral Kent C. Melhorn (MC.),
U. S. N.



—Harris & Ewing Photo.

Capt. Montgomery A. Stuart (MC),
U. S. N.



Dr. Ruix Leon.



Dr. Louis Hippolyte.



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THE PREVENTION AND TREATMENT OF AEROTITIS MEDIA^{1 2}

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Aerotitis media is characterized by middle-ear lesions caused by failure to equalize pressure between the middle ear and the surrounding atmosphere. It is the difference between the two pressures, not the absolute value of either pressure, that calls forth the series of tissue changes known collectively as aerotitis media. Equalization of pressure normally occurs by the passage of air through the eustachian tube during its momentary opening as in the act of swallowing or of yawning. The pathological changes vary from slight congestion to extensive rupture of tissues. There may be discomfort or even pain, bleeding, tinnitus, vertigo, and deafness. The syndrome has an acute, and in some individuals a chronic, aspect. Aerotitis media is also known as aero-otitis, aerotitis, otitic barotrauma, otic barotrauma, salpingotympanitis, and aviator's ear, among other terms. The term aerotitis media indicates at once the etiology, nature, and locus of the disorder.

Inability or failure to open the tube voluntarily at frequent intervals during the rapid change in pressure of the surrounding atmosphere is the inciting cause of the pressure differential that is the immediate cause of the lesions of aerotitis media. Efforts to prevent aerotitis media must therefore be directed toward maintenance or restoration of normal functioning of the eustachian tube. The treatment of aerotitis media looks toward alleviation of tissue damage arising as a result of the suction or "cupping" effect of the entrapped air in the middle ear.

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² Medical Research Department, U. S. Submarine Base, New London, Conn.

Previous efforts in the direction of prevention have had several aspects. It has been thought possible to reduce the incidence by a comprehensive selection program such that those men susceptible to aerotitis media would be excused from military situations demanding pressure equalization. Teed (34) for example, states: "A large percentage of damaged ears among submarine personnel could be avoided by a routine check of the ability of each candidate to autoinflate his ears. This is done by having him perform the Valsalva maneuver while the examiner observes his ear drum * * *. It is therefore not necessary to test the man under pressure to find out whether or not he can inflate his ears and equalize air pressure. It is my contention that if this program were carried out, the number of cases with otopathologic changes would be 2 or 3 percent rather than the present 25 or 30 percent."

Another type of preventive therapy has been the irradiation of the eustachian tube by radon or radium. Crowe and his coworkers (5) (6) (7) have shown that such irradiation restores normal patency to the tube in many cases.

The first applicator used was a glass capsule 1.5 cm. long and 0.5 mm. in diameter encased in a brass shell 1 mm. in thickness. When filled, each capsule contained 75 millicuries of a radio-active gas called radon. Crowe used 33 milligram hours to each side of the nasopharynx at 4 to 6 weeks intervals. The brass container filters out all but 8 percent of the beta radiation (12).

Because of its resistance to deterioration, later workers have largely substituted radium sulfate for radon. A variety of metals, principally platinum, have been used to contain the radium salt. Most workers are now using a capsule of Monel metal 2 cm. long, inside diameter 1.7 mm., with walls 0.3 mm. thick. Both beta and gamma rays are allowed to pass this filter, in contradistinction to platinum, which passes pure gamma radiation.

In all of our work with radium, 50 mg. of radium salt was applied once a month for 8 to 10 minutes to each side of the nasopharynx. Fowler calculates that with a Monel metal filter such as ours an exposure of 8.5 minutes equals 1,950 roentgens.

The rationale of the method we used is based upon the fact that adenoid tissue is especially sensitive to irradiation (32). It is assumed that improved functioning of the eustachian tube is associated with reducing excess lymphoid tissue about the torus tubarius.

Whether radium or radon is used will depend upon the needs of a particular activity. If funds are available and many patients are to be treated over long periods, it would be wise to invest in a radium applicator. These may be obtained for about \$1,500. On the other hand, if only a few patients are to be treated and no great initial

expense can be incurred, radon capsules will do quite as well. For both types of irradiation, care must be taken that both the patients and the operator are properly protected. The set-up should be inspected at the outset by a radiotherapist. Furthermore, since radon deteriorates very quickly, its time of application must be increased continually: the therapist will be able to furnish the necessary mathematics. In any case only an otologist should administer radium since only with competent use of the nasopharyngoscope can the progress of the irradiation be determined.

A third type of suggested preventive therapy, the possibility of dental correction of ear disturbances caused by variations in ear pressure, was first investigated by Wilhelmy (35). Costen (4) had previously reported observations on patients who had impaired hearing associated with closed bite; by "opening the bite" the hearing acuity of many of these patients was improved. Costen thought in case of overclosure of the mandible the internal pterygoid muscle relaxed and crowded the soft tissue against the pharyngeal opening of the eustachian tube, causing a mechanical obstruction, and he concluded that the insertion of dental splints to restore the proper relationship corrected the condition, enabling the man to ventilate the middle ear.

Wilhelmy inserted splints to open the bite of a small group of aviators with overclosure of the mandible. Such a procedure appeared to give relief from distressing ear symptoms incidental to rapid altitude changes. Following this lead, Lowry (25) similarly treated 33 men with loss of intermaxillary distance. Of 26 men followed up, subjective impressions were as follows: 9 were symptom free, 14 felt some benefit from wearing splints, 3 derived no beneficial results.

Harvey and Morant (21) reported that they had used splints in cases of aerotitis media and found no improvement. They also found that aerotitis media was no more prevalent among men with malocclusion than among men with normal occlusion. In Teed's series of cases no instance was recognized of overclosure of the mandible affecting the proper functioning of the tube. He says: "With the nasopharyngoscope I have not been convinced that the internal pterygoid muscle impinges on the eustachian tube to any greater extent than normal. I doubt very much if this condition should be classed among the causes of eustachian tube obstruction."

Investigators at the United States Naval Air Training Center, Pensacola, Fla. (29), however, observed that ear blocks were found to occur five times as frequently with individuals with malocclusion as in individuals with normal occlusion.

Evidently an investigation of the divergences of these workers was imperative. Accordingly this laboratory decided to include in its investigation of the causes of aerotitis media the possibility of the

dental factor. This phase of the investigation was planned to determine the effects not only of overclosure of the mandible, but also of functional malocclusion upon eustachian tube function.

This laboratory designed its investigation to cover each of these three methods—selection, radium, and dentistry—suggested in the literature for prevention of recurrent aerotitis media.

ANATOMY

Inasmuch as it is an abnormal functioning of the eustachian tube which is the inciting cause of aerotitis media, the anatomy of the tube should be described. It consists of a bony and a cartilaginous part. The bony part is roughly a flattened funnel in shape, is about 12 mm. long, and arises from the upper part of the tympanic cavity. Its mucous membrane, which lies close to the bone, is covered with ciliated epithelium. The bony part passes downward, forward, and mediad, and joins the cartilaginous part without a definite line of demarcation. This juncture is known as the isthmus, and is the narrowest part of the tube.

The cartilaginous portion is about 24 mm. long from the isthmus to its opening high up on the lateral wall of the nasopharynx. Its size increases as the pharynx is approached, but normally its walls are apposed and it remains a vertical slit-like potential tube unless opened by action of the voluntary muscles or forced open by positive pressure in the middle ear. It is lined with columnar ciliated epithelium on a loose stroma containing mucous glands and diffuse lymphoid tissue (9). The cilia create a current toward the nasopharynx, thus helping to drain the middle ear. The lymphoid tissue near the mouth of the tube is known as the tubal, or Gerlach's, tonsil. This should not be confounded with the lymphoid tissue in the fossa of Rosenmueller, the part of the nasopharynx behind the torus tubarius of the pharyngeal opening of the eustachian tube.

The end of the tube, the pharyngeal ostium, acts as a flutter valve in that as a result of its contour it opens easily to allow the escape of air under pressure in the middle ear, and yet unless opened voluntarily it prevents passage of air into the middle ear.

Of the muscles near the eustachian tube, the tensor veli palatini is the most important in opening the lumen (31).

EFFECT OF CHANGE OF PRESSURE ON THE NORMAL FUNCTIONING OF THE EUSTACHIAN TUBE

An individual is subjected to a change of ambient air pressure whenever he goes from a more dense to a less dense atmosphere, or con-

versely from a less to a more dense atmosphere. Since the eustachian tube is normally closed, entrapping the air in the middle ear, it follows that with a change in ambient air pressure there results a pressure difference across the eardrum.

If the ambient air pressure is decreasing, the relative pressure of the entrapped air in the middle ear builds up until it is about 15 mm. of mercury³ greater than that of the air in the nasopharynx, at which time the eustachian tube is forced open and enough air escapes from the tympanum to equalize the pressure across the eardrum. As the ambient air pressure continues to decrease, the relative pressure in the tympanum again increases to 15 mm., whereupon more air escapes; and so on. We have found it rare for an individual to experience difficulty with this automatic process.

On the other hand, if the ambient air pressure is increasing, the mechanical effect of the differential pressure is not exerted to open the eustachian tube—rather it is exerted to keep the tube closed. If pressure is to be equalized, the eustachian tube must be opened by action of its muscles. If the tube is not opened by some means, a rather definite series of events will occur. Under increasing ambient air pressure a sense of fullness develops in the ears at a pressure of 3 to 5 mm. Discomfort is noted if the pressure is allowed to increase to 15 to 30 mm. Here there is diminished hearing as a result of retraction of the eardrum and consequent telescoping of the ossicles. Above 30 mm. pressure there may be pain, tinnitus, bleeding, and even vertigo and nausea. Pressures of 80 to 90 mm. give great pain, and the severity of all symptoms increases.

At any time during the increase up to 80 to 90 mm., the eustachian tube can be opened by any of a wide variety of actions—swallowing, yawning, sneezing, screaming, contracting the throat, or forced expiration while holding the nose (the Valsalva maneuver). Most experienced divers and flyers have learned favorite ways of “clearing” their ears. If this is done from time to time while the pressure is increasing, no symptomatology need appear and the subject will be able to sustain great amounts of pressure without contracting aerotitis media. It is only when something goes wrong with the intermittent equalization process that the typical syndrome appears.

A relative pressure of 80 to 90 mm. acting against the pharyngeal opening of the eustachian tube is, however, usually above that which the tubal muscles can overcome, whereupon with any increase in pres-

³ This figure is for sea level air density. All pressure readings in mm. must take density into account. We have seen an electric fan, running rapidly at sea level, almost stop as a result of the extra load when the air pressure was raised to 3.4 atmospheres.

sure the tube becomes "locked"—the walls are pressed so tightly that the muscular reflexes which normally open the tube are unable to exert their usual effect, and the pressure must be reduced before equalization can occur. When the pressure difference reaches 150 to 540 mm., rupture of the eardrum will result.

ETIOLOGY AND SYMPTOMATOLOGY

Most persons are able to inflate the middle ear at will. Many persons, however, are not able to do so voluntarily, usually because of some obstruction of the eustachian tube. There may be colds, with infection of the lymphoid tissue underlying the epithelium so that the lumen is entirely closed, or there may be sufficient excess tissue to block the tube even with no infection. There may be other types of congestion, or there may be paralysis or atypical function of the tubal dilator muscles.

But even with subjects who can ordinarily inflate the middle ear voluntarily, there may be occasions when it becomes impossible, as during periods of sleep (babies in airplanes are particularly susceptible) or of unconsciousness, or during the condition of "locked" tube as previously described. The element of rate of pressure change must also be considered—that is to say, a subject may be able to maintain equal pressure across the eardrum at one rate of change, but be unable to accomplish this if the rate is increased.

With an individual unable to inflate the tympanum, or unable to do so with sufficient speed, a series of pathological events may occur in the tissues of the middle ear whenever pressure is administered. These events are characterized by vascular rupture and by the pulling apart or separating of tissue layers.

The immediate cause of the otopathology appears to lie in a pressure differential between the entrapped air in the tympanum, and a component of ambient air pressure transmitted to and expressed in the tissues involved. When this occurs, so that, for example, within a capillary or arteriole the pressure is greater than in the surrounding air, the vessel will expand and may rupture, allowing free blood and serum to escape. The same "suction" effect may cause the outer layer or layers of certain tissues to be pulled loose. The eardrum layers may for example become separated in this manner.

We have followed Teed in describing and grading the symptomatology of aerotitis media. A perfectly normal ear is described as No. 0. An ear showing some congestion in Shrapnell's membrane and along the handle of the malleus is described No. 1. Retraction and an extensive and fiery-red congestion of the entire drum and tympanum characterizes a No. 2 ear. A No. 3 ear exhibits the same symptoms

as No. 2 but in addition there is evidence of ruptured vessels in the drum. A No. 4 ear is characterized by extensive vascular rupture, with bleeding in the middle ear and from the eustachian tube. There may be dissecting hemorrhages in the layers of the eardrum. The eardrum may actually be ruptured or there may be bleb formation in the canal. The whole middle ear may become filled with blood mixed with air, or filled with blood alone, in which case the drum appears purple or black. These last cases we have termed No. 5 ears because of a differential effect on acuity.

In addition to the objective description with the use of the otoscope and nasopharyngoscope, a number of other observations are of importance. A few patients develop vertigo and nausea. Commonly, pain occurs radiating down the side of the face to the throat, or it may be deep-seated in the ear. Sometimes it is rather mild, and a ruptured drum may occur before the patient feels more than a transitory needle-like pain. Often there is tinnitus, usually a roaring noise. Stuffiness and "dullness" of the ears are common—many patients state that it seems they were talking "with their head in a bucket." Many complain of reduced auditory acuity, though we have found their subjective feeling of deafness is not always to be trusted.

These subjective symptoms may be found in varying degrees in all grades of damage according to the graded scale. However, no very close correlation can be drawn between, for example, pain and grade of damage. It has proved to us much more satisfactory to rely upon the objective data we were able to obtain.

EXPERIMENTAL DESIGN

CONDITIONS OF ADMINISTRATION OF PRESSURE

The submarine-escape training tank is a tower containing a column of fresh, clear water 25 feet in diameter and 100 feet deep. Escape hatches are located at depths of 18, 50, and 100 feet. The hatches are constructed in a manner similar to the escape hatch of a submarine. Men are required to enter a hatch, submit to a pressure increase appropriate to the depth of the hatch, don a submarine-escape appliance, or "lung", pass from the hatch to the water, and ascend to the surface.

As a preliminary check on the ability of the men to undergo the pressures involved in these hatch escapes, they are first required to enter a dry recompression chamber where they are subjected to 50 pounds (3.4 atmospheres) pressure in from 3 to 10 minutes, depending on the trouble experienced by individuals in any particular group. If a man is in such pain that he cannot continue, he is "locked" out of the chamber and excused from that day's pressure test. Fifty pounds

pressure is as much as the men will need in the course of their escape training, and it is with the dry recompression phase only that this experiment deals.

SUBJECTS

All men used in this study were young, healthy males, averaging in the early twenties, with an IQ of 95 or higher. Very few had any previous experience in taking pressure, although in this report both experienced and inexperienced men are included. All had passed on the preceding day a rigorous physical and psychiatric examination for entrance to the submarine service, the most highly selected group of enlisted men in the country.

PREPRESSURE EXAMINATION

On the day before pressure, each man received a pure tone audiogram at the 6 octaves 256–8,192 c. p. s. This was administered by a well-trained audiometrician using a Western Electric 6B machine in a soundproof anechoic chamber. Attenuation of outside noise in this chamber is over 90 db.

Each man received a careful examination with an otoscope, the condition of his ears being made a matter of detailed record. In addition, each man received an examination with the nasopharyngoscope. This instrument provides a view of the entire nasopharynx. We have found that it may be inserted along the floor of the nose without, in the vast majority of cases, any preliminary anesthesia or astringent.

With the use of this instrument the eustachian tubes were labelled "open," "flat," "closed," or "covered," and the adenoids were listed on a 5-point scale from "small" to enormous." Any unusual conditions, such as congestion or plugs, were noted. In addition, the presence or absence of colds was ascertained by objective means. Those who had severe colds, or who for some other reason it was thought would be unable to take pressure, were excused from doing so until their troubles were corrected. There were, for example, a few men with psychological disturbances arising from the imminence of a pressure test. When all men had been thoroughly examined and selected, they were sent for a pressure test.

POSTPRESSURE EXAMINATION

Immediately upon completion of the dry pressure test each man was examined carefully with the otoscope. Every ear was assigned a grade of damage according to the graded system. Several hundred men were given a postpressure audiogram. At the sign of any otopathology in a particular ear, that man was carefully examined with the

nasopharyngoscope. A daily log was kept with descriptions of all ears suffering damage. These protocols could then be compared with those on the same men from the prepressure examination.

CONTROL AND EXPERIMENTAL GROUPS

(A) *Nondental*.—Of those not contracting aerotitis media, a group was required after the lapse of 1 week to take pressure a second time as a normal control procedure. In this, as with all other groups, the percent of those failing to complete the test, the percent of those contracting aerotitis media, and the average grade of damage, were carefully noted and made the basis for group-to-group comparison.

Of those contracting aerotitis media, a control group was required after the lapse of 1 week to take pressure a second time, no therapy whatsoever having been given in the interim. Of the others exhibiting the syndrome, men were assigned at random to experimental groups for treatment as follows:

(1) *Psychological*.—This sort of treatment consisted of assuring the subject that in 10 days, or less, his ears would heal and he would experience no difficulty a second time. He was subsequently instructed again in the Valsalva maneuver and given a second pressure test, the otologist usually present in the chamber for individual example and instruction.

For a period, alternate groups were presented with band music during pressure. It was supposed that the rhythm or the relaxation induced would be of benefit. Again, with certain groups, half of the number were given chewing gum to masticate during pressure.

(2) *Symptomatic*.—Every 2 hours for 6 to 8 hours before a second pressure test, individuals with symptoms of aerotitis media were instructed to apply drops of $\frac{1}{4}$ percent neosynephrine in physiologic saline solution to the nose.

(3) *X-ray*.—A random sample of those exhibiting severe otopathology were to be exposed to an appropriate dose of x-rays in an attempt to shrink certain tissues. As described later, it became impossible to make more than a start with this type of therapy.

(4) *Radium*.—A random sample was selected from those men with otopathology who had exhibited excessive lymphoid tissue in and about the orifice of the eustachian tube and in the fossa of Rosenmueller. With a small applicator, radium was applied to the orifice of the eustachian tube according to Crowe's and Burnam's technique, but without anesthetic (6). Fifty milligrams of radium salt were applied once a month for 8 to 10 minutes to each side of the nasopharynx.

The radium applicator is a hollow Monel metal chamber 2 cm. long containing the radium. This cylinder is brazed to a wire by which it is handled. With the patient on his back, the applicator is passed slowly along the floor of the nose following the same pathway as the nasopharyngoscope, until the middle of the radium chamber touches the orifice of the eustachian tube. (The correct depth can be determined by inserting a nasopharyngoscope in one side and a dummy applicator in the other.) A similar radium applicator is then placed in contact with the orifice of the

other tube, and a clamp is placed over the handles of the applicators in such a way that the inner tips are forced outward against the tissues it is desired to shrink.

Successive radium treatments were given to individuals at intervals of about 1 month. One group was required to take a pressure test after every treatment, others were required to wait until a course of three or four treatments was completed.

(B) *Dental*.—Most of the earlier dental work was subject to the following criticisms:

(1) All conclusions were based upon subjective symptoms, relying on the man's statement that his ears had or had not improved following treatment;

(2) The classification of malocclusion was based upon a static relationship of the jaws;

(3) Usually only those cases with overclosure of the mandible were selected; and

(4) X-rays of the temporomandibular articulation in both the open and the closed positions were not utilized in diagnosis.

The dental aspect of this study being so controversial, especial care was taken in this investigation to insure reliable conclusions, whether positive or negative. Subjective symptoms were never used as criteria of success or failure of dental treatment. The criterion of success was the normal appearance of the ear when viewed with the otoscope. If an individual contracting one of the more severe grades of aerotitis media was given dental treatment and he was subsequently able to sustain the same pressure test without again contracting the disorder, the dental treatment was considered successful. All results were checked by an otologist independently of the dentist. All successful cases, if any, were to be submitted to the same pressure test some months later to determine what degree of permanency was afforded by the treatment. All cases were checked with a nasopharyngoscope before and after treatment. Control and experimental groups were established as follows:

An untreated group which did not have aerotitis media on the first pressure test was repressured at intervals. An untreated group which did show aerotitis media on the first pressure test was repressured at intervals. The main experimental group of 50 subjects was taken at random from those men with any interference in mandibular functioning who showed aerotitis media following exposure to a first pressure test. An effort was made not to select cases on any other basis, such as amount of adenoid tissue, history of ear disease, etc.

The authors consider that an important addition to earlier work lies in the insistence of the present experiment upon a functional,

rather than a static, concept of malocclusion. The concept of function and motion has been extensively used in prosthetic dentistry. Several authors (18) (19) (15) (17) (27) have attempted to reproduce in a movable articulator the movements of the temporomandibular articulation.

It has long been recognized that the construction of satisfactory prosthesis for a complete or partially edentulous patient depends to a considerable extent upon how accurately mandibular movements are anticipated in the occlusion of the finished dentures. To anticipate these movements the appliances are assembled upon a movable articulator that reproduces mandibular motion within the limits of a mechanical device.

Our first consideration in establishing a routine diagnosis of malocclusion was that we were dealing with motion, and that any attempt to approach the problem from a static concept alone might end in failure. Following this functional concept x-rays were taken of both temporomandibular articulations in both open and closed positions and a full series of intraoral x-rays including bite wings to rule out foci of infection and to detect changes in the supporting structures. Impressions of both jaws were made and casts run up in stone. The models were then mounted in the Hanau articulator according to the technique described elsewhere by the dental author (23). With the casts mounted properly on the articulator, the points of premature tooth contact were marked and compared in the mouth. The models were then run through all paths of excursion and points of interference noted. These points were then checked in the mouth by having the patient duplicate the movements with carbon paper between the teeth. The inclined planes of the teeth around the points of premature contact were noted. Then, with a small stone, interfering inclined planes were reduced in an effort to provide unhampered excursions.

The intermaxillary distance in static occlusion was not altered in any way, since the cuspal points or occlusal sulci were not touched; only those planes which offered resistance to free excursion were reduced. Missing teeth were replaced. The occlusal portion of tilted teeth was placed in contact with the opposing arch by means of gold inlays, and unsatisfactory fillings were replaced.

The object of this procedure in every case was to restore an occlusal plane, fully equilibrated, that permitted unhampered movements of the mandible in the various excursions, and to provide adequate support in all balancing and working positions.

RESULTS AND DISCUSSION

VOLUME OF WORK

Since the official date of the start of this project, August 9, 1944, a total of 6,149 men have been examined before and after the 50 pounds dry pressure test. This includes otoscopy in all cases, and nasopharyngoscopy and audiometry in all but a few cases.

Of the men examined 1,659, or 26.9 percent, contracted more or less severe aerotitis media. Seven hundred and thirty-two of these cases of aerotitis media were treated with radium therapy. An attempt was made to administer radium at least 4 times in each case; in some cases as many as 8 treatments were needed. It was sometimes impossible to complete a series of 4 treatments when, for example, a man was unexpectedly transferred. But for the most part, therapy was completed and the man again admitted to the pressure chamber.

THE EFFECT OF WEATHER

It has often been supposed that weather conditions influence the onset of aerotitis media, but we conclude from our studies that where meteorological conditions appear to influence the onset of aerotitis media, the connection is indirect. We do not see any tendency for the disease to be associated in any way with temperature or barometric pressure.

Observations were taken at 0800 every morning just before each group was given pressure. The pressure and temperature curves are roughly similar, but for every interval where these seem related another interval in the month can be found where the opposite tendency is the rule.

A slight seasonal effect is apparent, there being slightly more disturbance in the winter months. Both the incidence of aerotitis media and the number of men failing pressure on the first trial are at a peak during March.

(It should be said here that a rise in both these variables during October, November, and December of 1945, is not explained as a seasonal phenomenon, but probably arises from a different factor altogether. Before VJ-day the men were examined by the otologist and sent through pressure on the next day; shortly after VJ-day the scheduling of the men was so changed that in many cases several days or even weeks elapsed between the examination and the taking of pressure. During this time the men had ample opportunity to contract upper respiratory infections which may have affected their ability to undergo pressure.)

The possibility of a slight seasonal difference is brought out by a comparison of the day-by-day records for a typical winter and a typical

summer month. The average percentage of failures for the whole month of January was 9.93, that for July only 6.25. The difference of 3.68 percent is 3.4 times its own standard error, indicating that there is less than 1 chance in 1,000 that the difference is due to the presence of chance factors.

The reader will carefully note that in the preceding paragraph we have been speaking not of the incidence of aerotitis media, but of pressure failures. The two are by no means the same thing. In this connection, we point out that the comparison of pressure failures for January and July is not corroborated by the comparative incidence of barotrauma, since indeed there the percentage is higher for July than for January.

The greater number of failures during January, while significant, does not of course necessarily mean that the difference is due to seasonal changes. At least as good a hypothesis is the possibility that in some indirect manner the untoward events of the war both in Europe and in the Pacific affected the readiness of some men to undergo pain and thus complete their pressure test satisfactorily. It was, for example, about this time that the Navy announced the loss of three submarines in one week.

What we must explain, therefore, is not the reliability of the difference between January and July, but why the difference is so slight. The explanation probably lies in our selection methods, by which all men with acute colds were excused from pressure. The result is that although the amount of upper respiratory infections in January is greater than in July, the number of men with colds actually taking the pressure is about the same from month to month.

Although, as we shall show, the presence of colds is of far less significance in aerotitis media than is usually claimed, we are forced to conclude, with regard to weather, that in our data no day-by-day or truly seasonal meteorological effects can be discerned.

EFFECT OF INTELLIGENCE

The intelligence of a group of 200 men who passed pressure and of a group of 200 who failed was compared. A tendency exists for those who failed to be slightly lower in intelligence, but the difference is statistically insignificant. It would be the part of caution, however, *not* to assume that intelligence is unrelated to the problem. Our men are highly selected. We can say nothing of the behavior under pressure of men in the lower levels of intelligence, but it is possible that with such men the factor of intelligence would take on added significance.

OBJECTIVE COLD AND ALLERGIC UPPER RESPIRATORY MANIFESTATIONS

Because of the prevalent opinion that the presence of upper respiratory infection contributes heavily to the onset of aerotitis media, it was decided to see whether most of the patients gave a history of cold at the time of the pressure test. Of a group of 232 men with aerotitis media, 38, or 16.3 percent, were listed by the otologist as having mild cold symptoms.

Evidently, within the limits of our data, the relation of mild colds to aerotitis media is not very pronounced. It is true that those with severe colds were excused from the pressure test; but on the other hand, we find 83.7 percent of our patients had no colds whatsoever, and we conclude that colds are by no means always an accompaniment of aerotitis media.

SIZE OF ADENOIDS

In view of the close approximation of the adenoids to the pharyngeal ostium and their effect on the function of the latter, one would expect that with larger and larger adenoids, more and more aerotitis media would occur. That this in general is true is concluded from figure 1, where the average grade of ear damage is related to size of

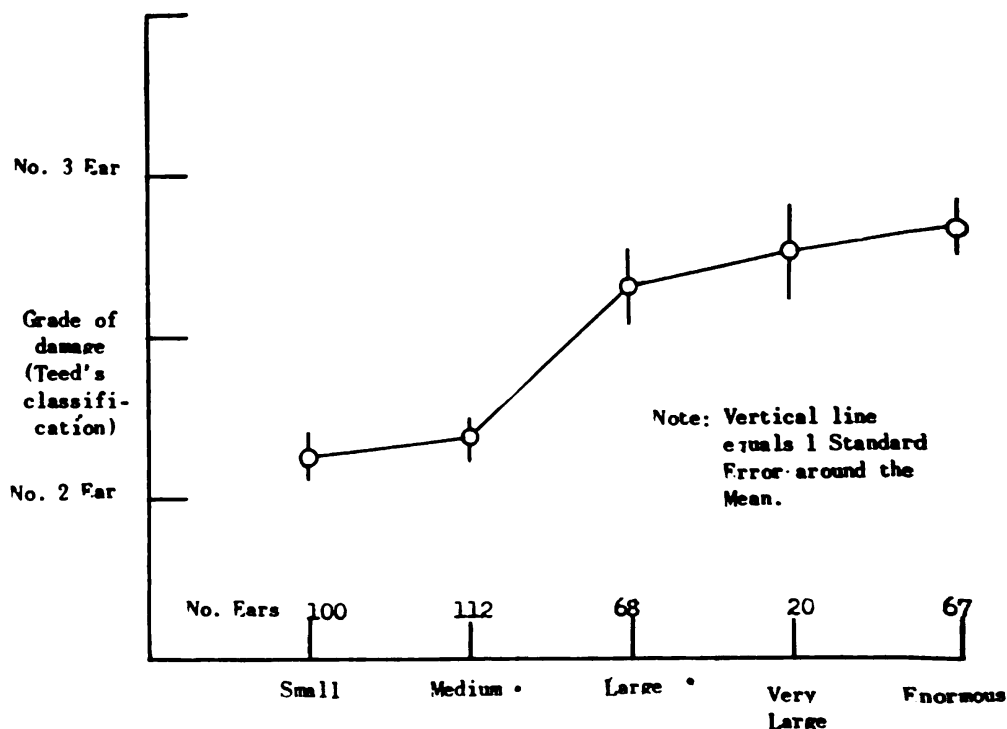


FIGURE 1.—Ear damage as related to size of adenoids. Routine nasopharyngoscopic examinations for a 2-month interval.

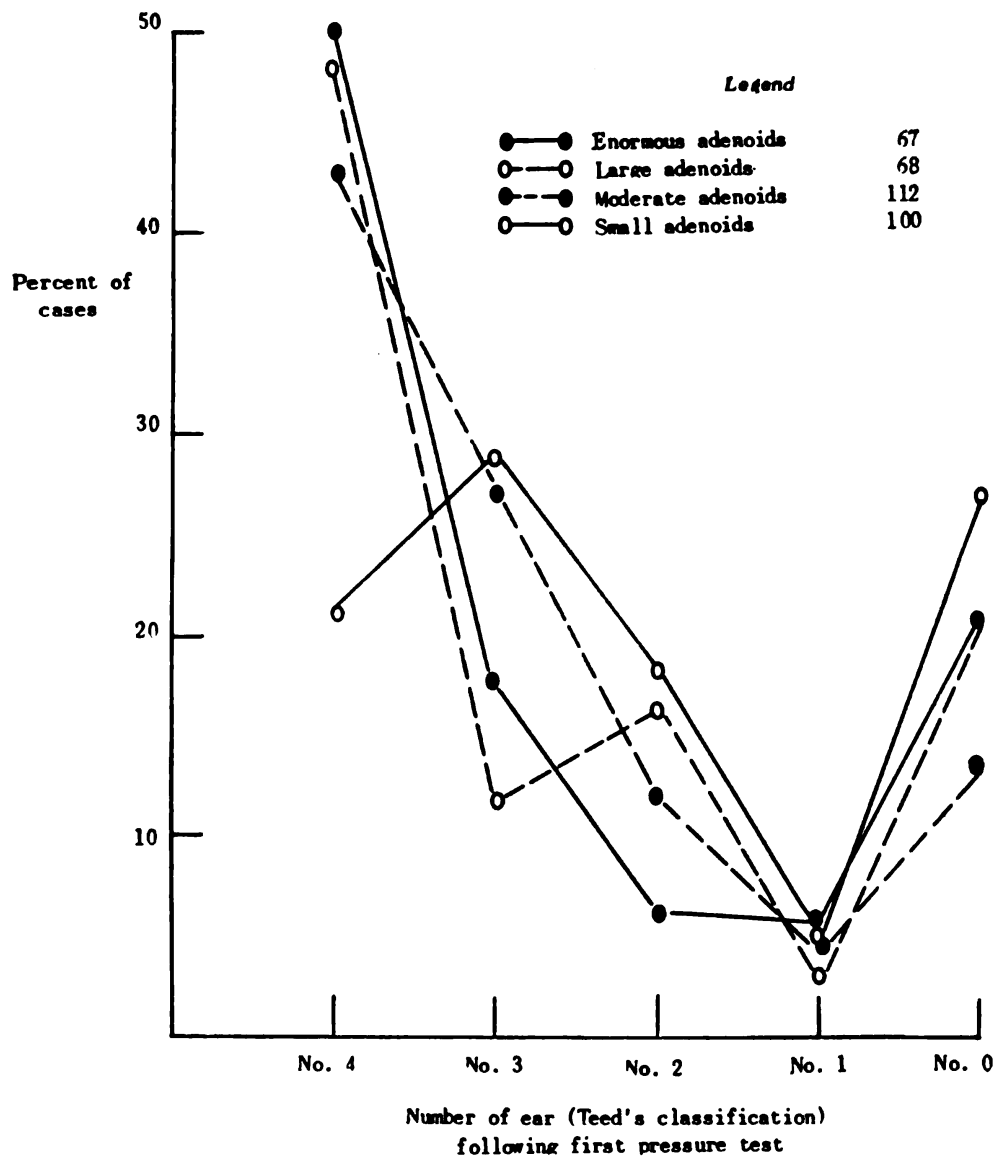


FIGURE 2.—Shows lack of precise relationship between size of adenoids and severity of aerotitis media.

adenoids. There is a strong and reliable tendency for the damage to increase in severity as the size of adenoids increases.

A sharp rise in figure 1 occurs as the adenoid size increases from "medium" to "large." Almost certainly the explanation lies in the fact that the "large" category includes those cases with lymphoid tissue in the fossa of Rosenmueller, while the "medium" category does not. It seems that the fossa of Rosenmueller occupies a strategic position with regard to its effect on the patency of the eustachian tube (6).

But the relationship between size of adenoids and severity of aerotitis media is not nearly so precise as appears from the condensed data in figure 1. A great deal of overlap occurs such that many patients with enormous adenoids have no trouble whatsoever with pressure, while on the other hand many with small or no adenoids sustain severe damage. Figure 2 presents frequency distributions of each of 4 groups, those with "small," "medium," "large," and "enormous" adenoids. Whereas 50 percent of the "enormous" group does contract aerotitis media, nevertheless over 20 percent of the "small" group does also—a sizable proportion. In addition it will be noted that about 20 percent of the "enormous" group maintains perfectly normal ears.

CONDITION OF EUSTACHIAN TUBE

It was hoped that the appearance of the eustachian tube as seen through the nasopharyngoscope without astringents might be used for successful prediction, and indeed, a regular, though slight, increase in aerotitis media occurs as the eustachian tube is more and more occluded. However, inspection of the raw data reveals that too much overlap occurs for prediction in individual cases to be very successful. The severer grades of ear damage are by no means confined to those cases with covered or closed eustachian tubes—in fact more than 25 percent of patients with perfectly open tubes suffered No. 4 ears. Moreover, of these cases with covered tubes, about 15 percent had no trouble whatsoever in taking pressure.

We conclude that a definite relationship exists between the appearance of the eustachian tube and the ability to take pressure, but that the individual variation is too great to allow accurate prediction of just which men will contract aerotitis media.

ABILITY IN THE VALSALVA MANEUVER

In addition to studying the static appearance of the system we wished to obtain an idea of the functional properties as well in the form of the Valsalva maneuver. Before the pressure test a long series of men was checked on how well they could voluntarily inflate the middle ear. The records of 139 men who subsequently contracted aerotitis media were studied. It was found that over half, or 56.2%, had apparently had no difficulty with inflation beforehand. Thirty and nine-tenths percent were listed as having had some difficulty beforehand, while the remaining 12.9 percent were in a poor category. It is evident from these figures that the ability to perform the Valsalva during a preliminary examination is no certain guarantee that during actual pressures the maneuver will always be successful. Nevertheless, as we shall show, we have in the Valsalva the best predictive measure of aerotitis.

A total of 588 men who did not contract aerotitis media was drawn from the same weekly intervals as the 139 men mentioned in the preceding paragraph. The results from the two groups are compared in table 1 which compares ability at Valsalva of those contracting aerotitis media with those not contracting.

When the absolute figures are treated according to the Chi-Square technique, it appears that the difference between the control group and the aerotitis media group is significant at the 1 percent level for all three categories of ability in Valsalva.

TABLE 1.—*Ability at Valsalva*

Aerotitis media	Number of men	Ability			Total
		Good	Poor	Doubtful	
		Percent	Percent	Percent	Percent
Contracted	139	56.2	12.9	30.9	100
Not contracted	588	78.2	.5	21.3	100

For practical purposes we can say that a somewhat greater probability exists for a man to have passed a preliminary Valsalva if he does not contract aerotitis media, and that if he *does* contract it, the chances are nearly 1 in 2 that he had some trouble with the Valsalva.

In order to make our statements more precise the data must be treated in another way. We may specifically inquire what the chances are of a man contracting aerotitis media if he is labelled by the otologist good, doubtful, or poor on ability at Valsalva. Table 2 gives an answer. The raw data which show successful prediction of aerotitis media by ability at the Valsalva maneuver, are the same as in table 1.

TABLE 2.—*Ability at Valsalva*

Ability	Number of men	Aerotitis media		Total
		Contracted	Not contracted	
		Percent	Percent	Percent
Good	538	11.5	85.5	100
Poor	21	85.7	14.3	100
Doubtful	168	25.5	74.5	100

Table 2 shows the prediction of which a preliminary Valsalva is capable. Of those labelled "good," only 14.5 percent contracted aerotitis media, while 85.5 percent did not. This result at first looks very satisfactory until it is noticed that of those labelled "doubtful," 74.5 percent did *not* contract aerotitis media while only 25.5 percent did so. There are too few cases labelled "doubtful" to make any final

statement concerning that category; but it is certainly significant that so many as 18 of 21 "poor" cases did contract aerotitis media.

The figures of 14.5 and 25.5 percent contracting aerotitis media for those men labelled "good" and "doubtful" respectively, are reliable at a satisfactory level of confidence (2 percent level), but it is clear that since about 3 out of 4 of those labelled "doubtful" do not contract aerotitis media, it is impractical to prevent these cases from attempting the pressure test. Furthermore, if all such cases were eliminated, the prevention of aerotitis media would still not be complete since about 15 percent of those labelled "good" would experience difficulty. It would probably be an efficient procedure to eliminate all "poor" cases at the start or until they received appropriate treatment.

We conclude that unless a man is in the lowest 2 or 3 percent, a preliminary test of ability at the Valsalva maneuver provides only a rough guide to a man's ability to take a subsequent pressure test.

PREVIOUS EXPERIENCE WITH PRESSURE

Another factor which is probably related to the ability to take pressure without ear damage, is demonstrated ability to have taken it in the past. We have compared a group of 495 candidates for Submarine School with a group of 658 experienced submariners. Almost none of the former had ever taken pressure while all of the latter were more or less familiar with pressure from experience with our training tank or the one at Pearl Harbor, in diving school or salvage operations, or in the escape hatch of a submarine. The two groups were given pressure during the same time intervals, and often the groups were simultaneously in the pressure chamber. The natural selection operating in the case of the experienced men is reflected in the fact that only 18.0 percent of them contracted aerotitis media as against 27.2 percent for the inexperienced men. This difference is highly reliable and it is a defensible hypothesis that it rests upon the fact of previous acquaintance with the whole situation.

It can certainly not be said, however, that repeated exposure to pressure will alone finally result in the ability to overcome an initial failure. When men contract aerotitis media on a first pressure test and are then given a second try with only symptomatic treatment in the intervening days, more than 90 percent will again contract the condition. We have a number of cases in our files of men who have been sent through pressure a half-dozen times or more, each time waiting until the previous trouble had cleared up, and each time the same symptoms appeared.

We conclude that if a man can pass our pressure test once he can pass it twice, but if he cannot pass it the first time, he needs more than cursory attention before he attempts it again.

DISCUSSION AND CONCLUSIONS OF PREDICTION EXPERIMENTS

Our study has failed to find a means of stating with precision whether a man can sustain pressure without ear damage. We have been disappointed not only in our attempt to predict individual cases, but even in an attempt to lower the over-all incidence of 25 to 30 percent. We had been led by Dr. Teed's work to expect a distinct drop in incidence as a result of more careful selection. He says, "A large percentage of damaged ears among submarine personnel could be avoided by a routine check of the ability of each candidate to autoinflate his ears. This is done by having him perform the Valsalva maneuver while the examiner observes the eardrum * * *. In my experience, in any group of 30 men 7 to 9 would be unable to inflate the ears. If examination of the nose and throat disclosed infection, the infection would be treated. In a week or 10 days the group would be tested again, and if then able to inflate the ears, would be allowed to take the tests. If not, more time would be given for recovery. Probably all but 1 or 2 would eventually pass, the small remainder requiring further treatment."

Unfortunately we saw from table 2 that if we consider only those men who perform the Valsalva satisfactorily, still 14.5 percent contract aerotitis media, and we therefore feel that Teed's predicted figure of 2 to 3 percent is not attainable with the use of Valsalva only. It would seem that an incidence of about 15 percent is a sort of theoretical "floor" below which present selection methods cannot go. At least, in all the thousands of men examined here, our lowest incidence for a reasonably large sample of experienced men has never been lower than 18 percent.

Since the month-by-month incidence of aerotitis media is practically the same it is fairly clear that all we did in prediction and selection was of little avail. When this fact is combined with work to be reported later on in this paper concerning the effect of radium therapy on the incidence of aerotitis media, the conclusion is forced on us that in this case a distinct difference exists between the prediction of aerotitis media and the determination of its cause. It will be shown that the cause of aerotitis media in most cases is the presence of excess tissue in and around the opening of the eustachian tube; but we have already seen that the size of adenoids is itself not a very precise predictor of subsequent aerotitis media. Evidently a rather clear knowledge of the cause of aerotitis media is not as yet sufficient to prevent its occurrence with any real certainty.

In this paper we have shown that a sizable percentage of men with aerotitis media nevertheless had small adenoids, open eustachian tubes, and good ability at the Valsalva maneuver. One reason why this may be so is that, in the pressure chamber, some men may let the in-

creasing pressure "get ahead" of them one or more times, and inflate their ears only after some damage has been done. This may occur even with men perfectly capable of autoinflation.

Another explanation may be that some men are especially susceptible to pressure so that even though they are inflating their ears regularly and without discomfort during increasing pressure, nevertheless the slight pressure differential existing each time before the ears are voluntarily inflated is enough cumulatively to cause some otopathology.

THERAPY

(a) *The effect of topical therapy.*—The effect of topical therapy in the form of nose drops was investigated by treating men with $\frac{1}{4}$ percent solution of neosynephrine in physiologic saline solution. A random sample of men contracting aerotitis media on their first pressure test was instructed to administer 5 drops every 2 hours starting at 0730. These men were then sent through pressure a second time at approximately 1300.

Little effect of the nose drops could be discerned. The average incidence of aerotitis media on the second test ranged from 83.1 to 84.0 percent. This figure is slightly better than that with men who receive a second pressure test with no therapy at all.

(b) *The effect of psychological therapy.*—A number of procedures of a minor nature were tried in an attempt to reduce the undesirable effects of pressure. Specifically, the use of chewing gum, the playing of music, and man-to-man encouragement by the otologist, were all given extensive trial.

In none of this work was any reduction observed either in percent of pressure failures or incidence of aerotitis media. A group of 120 men was instructed to chew gum vigorously during pressure, and compared with a group of 142 men given no gum. No difference between the groups was found.

Music provided by a 5-piece orchestra through a loud-speaker in the pressure chamber was presented to a total of 276 men, compared with a total of 586 men during the same time interval but given no music. There was a difference of only 0.6 percent between the groups.

For a period of 2 months, small groups of men contracting aerotitis media on a first pressure test were told that their trouble was of a minor character and would clear up in 1 week or 10 days, and that they would experience no trouble in passing a second test. No therapy other than this suggestive sort was given. In addition, they were told that if they did not pass the second test, their off-the-base liberty would be removed for 1 day. Then, during the second test, the otologist took the pressure along with the men, encouraging and instructing them by example and by talking to them individually. No

effect whatever on the incidence of aerotitis media was found from our most strenuous efforts in the psychological direction. Pressure failures, however, were reduced.

(c) *The effect of x-ray therapy.*—Our program for investigating x-ray as a means of shrinking excess tissue around the eustachian tube was stopped for administrative reasons before conclusive results were obtained. Arrangements were made through the commanding officer of the U. S. Naval Hospital, Brooklyn, N. Y., and patients were sent there for x-ray treatment. Although we do not have data of our own, we feel that x-ray should prove beneficial (30).

(d) *The effect of radium therapy.*—It can quickly be shown from figure 3 that radium therapy has a most satisfactory effect on men who could not take pressure without suffering ear damage. The lower line represents the incidence of aerotitis media in men after they had completed a course of radium treatments. The percentage has dropped to an amount considerably less than that of a usual group of

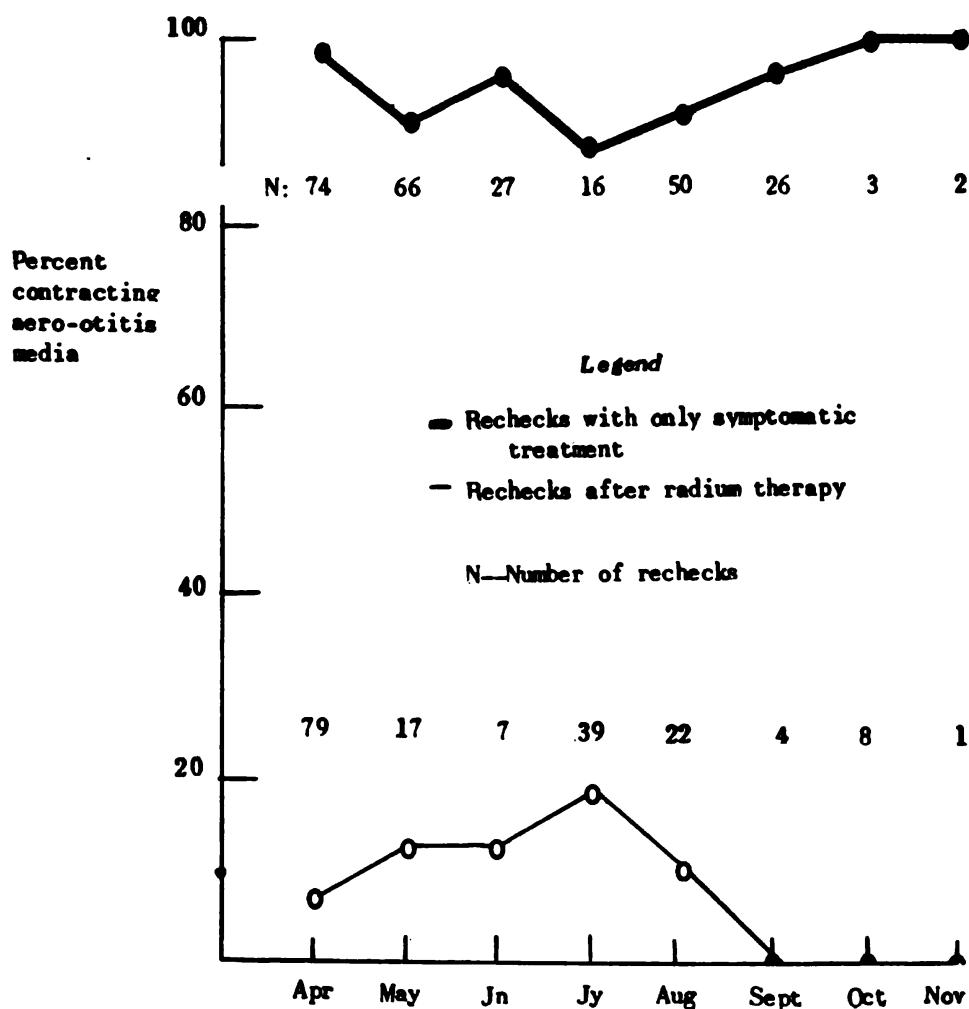


FIGURE 3.—Effect of radium therapy on incidence of aerotitis media.

men. A control group, similar in all respects to the treated group, is represented by the top line of figure 3. Of these men, sent back through pressure with only symptomatic treatment, well over 90 percent again contracted aerotitis media as contrasted with an average of about 10 percent for those following completion of radium therapy.

The number of men involved is enough so that we are able to conclude that radium therapy is successful in 9 cases out of 10. For those men whom radium does not assist in taking pressure, it may be true that further radium would be effective, or it may well be that other conditions besides excessive tissue produced the trouble in the first place.

During the final month of our study, for example, three cases failed to respond to radium treatment. In two of these cases old mastoiditis had caused considerable scarring, while the other had a postdiphtheritic paralysis of the right side of the throat and palate. The latter failed to move or open the eustachian tube on swallowing or inflation. His tympanum could, however, be inflated easily with a eustachian catheter. The tympani of the other two men could not be inflated with catheterization.

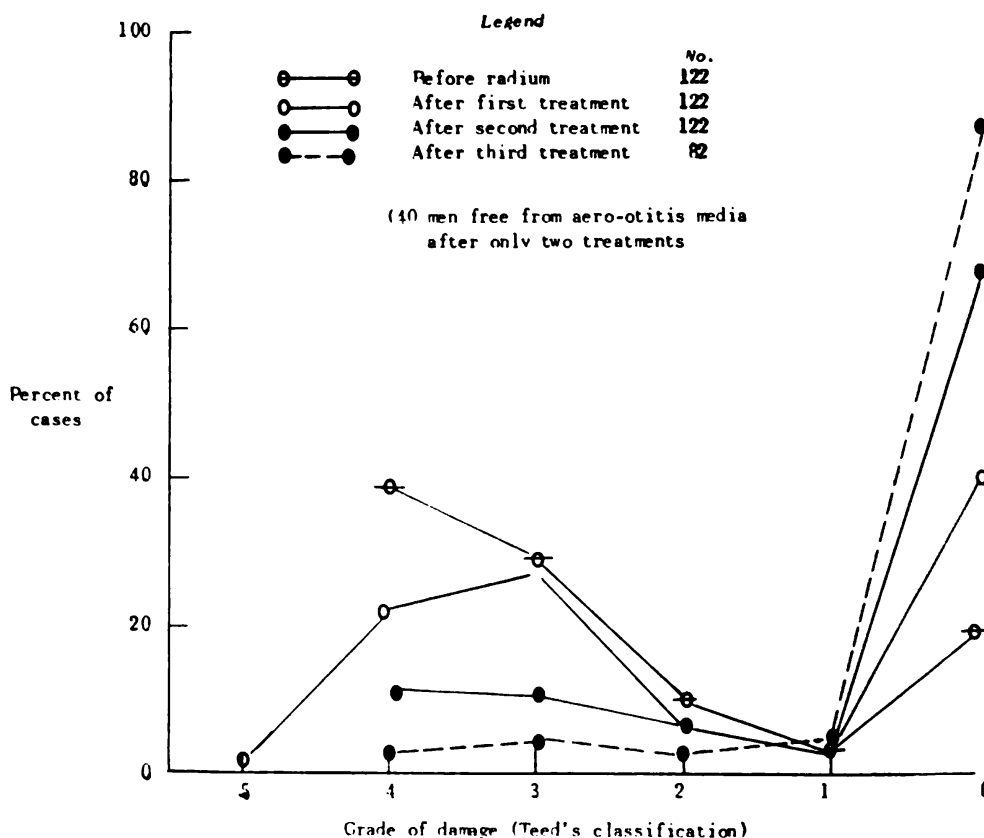


FIGURE 4.—Frequency distribution of ear damage following successive radium treatments.

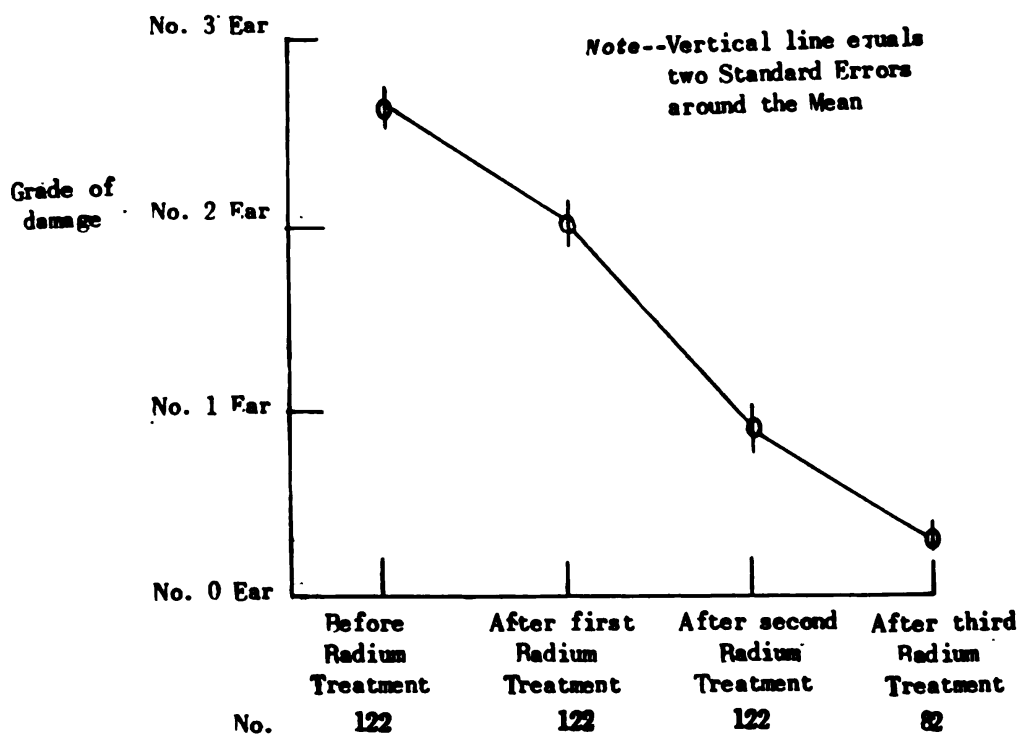


FIGURE 5.—Ear damage as related to number of radium treatments.

In order to study the effects of successive radium treatments, a group of 122 men was sent through pressure again after every treatment instead of waiting until their radium series was completed. For these men, not only incidence of aerotitis media was noted but also the grade of damage to each ear. Figure 4 gives the percentage of each grade of damage for the ears before treatment, and the percentage of each grade of damage for each succeeding treatment. The graph may be read in vertical dimension, thus: 38 percent of the ears were rated No. 4 before treatment, 21 percent were rated No. 4 after 1 treatment, 9 percent after 2 treatments, and 2 percent after 3 treatments. Conversely, 20 percent of the ears were rated No. 0 before treatment, and 88 percent after 3 treatments.

In these patients, No. 0 ears before treatment are found because the disorder is not always bilateral; in one series of 250 patients there were 152 unilateral cases, and 55 and 43 with trouble only in the right and left ear respectively.

The average grade of damage throughout the radium series for these 122 men is summarized in figure 5. A steady and highly reliable decrease in damage is seen, starting from nearly a No. 3 ear and declining practically to a No. 0 ear. Forty men were available for two treatments only, but even after two treatments figure 5 shows that most ears sustain little or no damage when again subjected to pressure.

(e) *The effect of dental therapy.*—Over a period of 10 months, 50 patients with aerotitis media were given dental treatment. Following dental treatment the men were subjected to a 50 pounds pressure test and when they emerged from the chamber their ears were checked by an independent observer with the otoscope. Although before treatment the ear damage from pressure had ranged from No. 3 to No. 5 either unilaterally or bilaterally, after treatment 46 of the 50 patients sustained pressure with No. 0, or absolutely normal, ears.

In working with these cases, the following classification of functional malocclusion was developed:

(1) Simple: Normal vertical dimension; anterior or posterior premature occlusal contact; interference in either right or left lateral excursion or both (extensive occlusion rehabilitation unnecessary).

(2) Compound: Normal vertical dimension; tilting and drifting of teeth due to non-replacement of missing teeth; static malocclusion; extensive anterior or posterior premature occlusion contacts; extensive unilateral or bilateral premature contacts in those excursions with inadequate balancing and working sides.

(3) Complex: Having any or a combination of the conditions found in (2) complicated by abnormal vertical dimension through either overclosure or overopening of the mandible.

Among our 46 successful cases, 5 showed overopening of the intermaxillary distance caused by the earlier loss of 6-year molars and the subsequent tilting and drifting of other teeth in the molar region. These men were treated by the reduction of the occlusal surfaces of the offending tooth or teeth or by the removal of third molars; the removal of lateral premature contacts was usually sufficient to create a successful case. These 5 men were of great interest to us, as the possibility of over-opening of the intermaxillary distance had never previously been considered as a possible factor in aerotitis media.

Splints were employed in three cases. In each of these, a number of molar teeth were missing. Superior displacement of the condyle heads could be demonstrated in the glenoid fossae radiographically.

Ten men would be classed as normal according to the standard static concept of occlusion, but when studied in motion, pronounced premature and interfering contacts could be demonstrated causing the condyle heads to assume strained articular relationships. Reduction of the offending inclined planes was sufficient treatment.

In all cases of this series with unilateral aerotitis media the occlusal interference in lateral excursion was always on the side *away from* the affected ear.

Of the four unsuccessful cases, three yielded to radium therapy. The fourth case resisted all our efforts.

Two of the forty-six men had not responded to radium treatment but did respond readily to dental treatment.

The untreated control group which did not have aerotitis media on the first pressure test did not contract this disorder in subsequent tests. The untreated control group which did show aerotitis media on a first pressure test continued to show the disorder on subsequent tests.

We were able to repressure 10 of the 46 men some months after treatment; the ears were still negative and we conclude that the effects of the treatment are relatively permanent.

Many cases were seen (not in this series of 50) where there was definite static or functional malocclusion or both. Yet no aerotitis media was observed. Temporomandibular x-rays of 25 of these cases in both open and closed positions showed uniformly flat glenoid fossae; in these cases there appeared to be little mechanical interference with mandibular excursion despite the type of malocclusion present.

In considering the results of dental treatment it seems to us clear that the Costen hypothesis is inadequate to explain our results. Indeed, most cases of overclosure of the mandible do not develop aerotitis media. Our own hypothesis was developed in conversation with Dr. Stacy Guild of the Department of Otology of Johns Hopkins University School of Medicine. It is well known that muscular activity is a most important factor in lymphatic circulation. Abnormal jaw movements therefore may set up fascial and muscular tensions interfering with free lymphatic drainage of the middle ear and the eustachian tube. In the present connection this chain of events is thought to be as follows: The dental treatment described restores normal action to the buccinator muscle; this muscle in turn affects the action of the superior pharyngeal constrictor due to their continuity through the pterygomandibular raphe. Restoring normal action to the superior pharyngeal constrictor muscle (which lies in the closest connection to the lateral pharyngeal gland, the most important lymph node draining the eustachian tube and middle ear), permits a free drainage of lymph by removing a tourniquet effect and restoring the "milking" action on the lymphatic system. Stimulation of lymphatic drainage quickly relieves mucosal congestion and edema of the eustachian tube.

It will be apparent that this dental technique is expensive and time-consuming. After it had been determined that the dental treatment was successful in the large majority of cases, it seemed wise to seek for a shorter procedure to determine what prosthesis should be employed. This was especially true since it had been found that a rel-

atively simple equilibration of occlusion in a number of men was successful in preventing a recurrence of aerotitis media. As this procedure was not complicated and could usually be carried out in a few hours, a group of men failing pressure on a second attempt and showing interference in mandible function was picked at random. Static occlusion was studied. Next the patient was instructed to make a right and then a left lateral excursion. Any pronounced points of interference were observed, as well as the degree of support afforded on both balancing and working sides. He was then instructed to make a protrusive excursion and the degree of molar support if any was noted. All inclined planes which were related to lost molar support were evaluated. Carbon paper was then inserted between the teeth and the patient instructed to go through all the paths of excursion. Points of interference not visible to the operator were thus discovered. The results of these observations allowed the reducing of interfering inclined planes to provide unhampered mandibular excursions.

With five patients treated by this rapid procedure, three were able to undergo aerotitis media without any symptomatology; the other two were able to undergo pressure but some otopathology did develop.

AUDITORY ACUITY

It is our finding that the deafness usually stated to accompany aerotitis media is not so common as usually thought. In this we agree with Fowler (13) who says "There is, as a rule, only slight deafness with aero-otitis. It is often transient."

Our original intention was to classify the average loss of acuity for each of the grades of damage. It soon appeared, however, that the less severe grades of damage were not accompanied by a great enough loss of acuity to distinguish from normal ears. Indeed, in the vast majority of cases with ears graded 1, 2 or 3, no loss of acuity could be demonstrated.

We prepared a composite postpressure audiogram for the first 100 No. 4 ears. This audiogram has been published elsewhere (20). The loss of acuity is significant in the statistical sense and in the sense that some subjects were aware of lowered hearing. However, the average loss (5 to 15 db.) is certainly not severe. There were even a few cases in which, at least at some frequencies, an improvement in acuity was exhibited. It was apparent that the otopathology of aerotitis media as seen through the otoscope is not a perfect or even a good index to the functional efficiency of the ear.

There were, however, a few ears with severer and relatively long-lasting impairment of hearing and we noted that those ears were typically characterized by a dark purple or bluish discoloration of the

ear drum, indicating a middle ear filled with blood unmingled with air. The loss averaged 20 to 30 db. through the frequencies 256 to 8192. It must be emphasized that these ears do not show any greater amount of otopathology than No. 4 ears. The essential difference is merely the presence in the middle ear of free serosanguineous fluid.

It is our hypothesis that severe deafness occasionally encountered in aerotitis media among submariners is not caused by insult to the tissues, but largely by the damping action of fluids in the tympanum.

Occasionally a tympanic membrane was ruptured in the pressure tank. Uncomplicated perforations caused an average loss of only 5 or 10 db.

Our conclusions on acuity differ from those of most writers who report deafness to be rather common and often more lasting. With most of the work before electronic equipment became available, however, considerable doubt existed as to the extent and nature of the deafness. More recently, a great deal has been written on the topic by flight surgeons (1) (2) (3) (26) (28) (33). It must be remembered, however, that auditory acuity is affected in several ways by high-altitude flight. There is, first of all, considerable auditory fatigue which may last for hours or days after descent. There may also be more or less acoustic trauma. The deafness reported by aircrews during high-altitude flight is certainly due at least partially to the decreasing intelligibility of speech under low pressure. Furthermore, during flight there is the possibility of an actual difference in pressure across the tympanic membrane with the consequent inefficient displacement of the ossicles.

A major difference between pressure conditions in submarines and aircraft is that the usual flight consists of a decompression followed by return to normal pressure, while submarine training consists of a compression followed by a return to normal pressure. In the case of submarines, then, it will be seen that the negative pressure in the tympanum which produced vascular engorgement and rupture during the first or compression phase, changes to positive pressure during the second or decompression phase, and the result is that the vascular system tends to shrink and a form of therapy is achieved. The reverse is true for the aviators, in whom the second phase is one of compression, the men reaching the ground at a time when symptoms are most pronounced. One might for these reasons expect a greater incidence and severity of otopathology and loss of acuity among aviators than among submariners.

SUMMARY AND CONCLUSIONS

1. Aerotitis media is the name given to a syndrome characterized by otopathology, particularly vascular rupture and separating of tissue

layers, caused by a differential barometric pressure across the eardrum. A description of aerotitis media is given, together with a discussion of anatomy and etiology.

2. An experiment was performed in an attempt to discover the causes and effects of the disorder, and to find the best means of prediction, prevention, and treatment. In the course of this experiment 6,149 submariners were subjected to 50 pounds positive pressure in a dry recompression chamber. They were examined minutely both before and after pressure by means of the otoscope, the nasopharyngoscope, and the pure tone audiometer, and all pertinent data were recorded.

3. A large group of men not contracting aerotitis media in the pressure chamber was required to undergo a second pressure test. Another group which did contract aerotitis media was likewise required to undergo a second pressure test after their otopathology had subsided; this group received no treatment whatever. These two groups served as control for five experimental groups given different types of treatment as follows: Psychological, topical, x-ray, radium, and dental. The types of treatment were all based on some rationale designed to assist the men in successfully taking pressure in the future.

4. Psychological treatment included additional motivation and encouragement, the use of chewing gum, and the use of music. None of these things reduced the incidence of aerotitis media on subsequent pressure tests.

5. Topical treatment consisted of $\frac{1}{4}$ percent neosynephrine solution in physiologic saline solution, applied locally for several hours before pressure. No effect was noted.

6. X-ray therapy was discontinued for administrative reasons and our results are inconclusive.

7. Radium therapy consisted in the application of a Monel metal cylinder 2 cm. long, outside diameter 2.3 mm., with walls 0.3 mm. thick, containing 50 mg. of radium salt, to the pharyngeal orifice of the eustachian tube for 8 to 10 minutes. This dose is effective, after 3 to 8 treatments separated by a month, in reducing excessive hyperplastic lymphoid tissue around the opening of the tube, thus permitting many men formerly unable voluntarily to open the tube now to do so, and consequently to become able to sustain pressure without contracting aerotitis media. The treatment, where indicated, is effective in well over 90 percent of cases.

8. A dynamic dental concept of malocclusion was the basis for successful treatment of 46 out of 50 cases of aerotitis media. The elimination of functional restriction of the buccinator and hence the superior pharyngeal constrictor due to their interrelationship through

the pterygomandibular raphe is thought to be the mechanism whereby a correction of malocclusion enables a man subsequently to sustain a pressure test.

9. No very efficient method was found to predict whether a man would contract aerotitis media. Positive correlations were indeed obtained with appearance of eustachian tubes, whether open, flat, closed, or covered, and with size of adenoids; but the magnitude of the relationship did not permit of good prediction in individual cases.

10. Rupturing the eardrum was found to produce a loss in acuity of 5 to 10 db.

11. Almost no effect on acuity could be found as a result of aerotitis media unless the middle ear was filled with free blood. Deafness among submariners is thus seen to be caused more by damping of the ossicles than by otopathology.

REFERENCES

1. ARMSTRONG, H. G. and HEIM, J. W.: Effect of flight on middle ear. *J. A. M. A.* 109: 417-421, Aug. 7, 1937.
2. BEAVEN, C. L.: Chronological history of aviation medicine. *Flight Surgeons' Topics* 2: 185-206, 1938.
3. CAMPBELL, P. A. and HARGREAVES, J.: Aviation deafness, acute and chronic. *Arch. Otolaryng.* 32: 417-428, Sept. 1940.
4. COSTEN, J. B.: Syndrome of ear and sinus symptoms dependent upon disturbed function of temporomandibular joint. *Ann. Otol., Rhin., & Laryng.* 43: 1-15, Mar. 1934.
5. CROWE, S. J. and BAYLOR, J. W.: Prevention of deafness. *J. A. M. A.* 112: 585-590, Feb. 18, 1939.
6. CROWE, S. J. and BURNAM, C. F.: Recognition, treatment, and prevention of hearing impairment in children. *Ann. Otol., Rhin., and Laryng.* 50: 15-31, Mar. 1941.
7. CROWE, S. J., GUILD, S. R., LANGER, E., LOCH, W. E., and ROBBINS, M. H.: Impaired hearing in school children, *Laryngoscope* 52: 790-804, Oct. 1942.
8. EMERSON, E. B., Jr., DOWDY, A. H., and HEATLY, C. A.: Use of radium in treatment of deafness by irradiation. *Arch. Otolaryng.* 35: 845-852, June 1942.
9. FARRIOR, J. B.: Histopathologic considerations in treatment of eustachian tube. *Arch. Otolaryng.* 37: 600-621, May 1943.
10. FARRIOR, J. B. and RICHARDSON, G. A.: Nasopharyngeal radium applicator. *Arch. Otolaryng.* 35: 811-812, May 1942.
11. FISHER, G. E.: Recognition and radium treatment of infected and hypertrophied lymphoid tissue in nasopharynx; preliminary report. *Arch. Otolaryng.* 37: 434-436, Mar. 1943.
12. FOWLER, E. P., Jr.: Irradiation of the eustachian tube. *Arch. Otolaryng.* 43: 1-11, Jan. 1946.
13. FOWLER, E. P., Jr.: Causes of deafness in flyers. *Arch. Otolaryng.* 42: 21-32, July 1945.
14. FOWLER, E. P., Jr.: Nonsurgical treatment for deafness. *Laryngoscope* 52: 204-217, Mar. 1942.

15. GYSI, A.: Some reasons for the necessity of using adaptable articulators. *Dental Digest* 37: 219-224, 1931.
16. HAINES, H. L., and HARRIS, J. D.: Aerotitis media in submariners. *Ann. of Otol., Rhin., and Laryng.* (In Press.)
17. HALL, R. E.: Analysis of development of articulator. *J. Am. Dent. A.* 17: 3-51, Jan. 1930.
18. HANAU, R. L.: Full denture prosthesis; intraoral technique for Hanau articulator, Model H, 4th edition. Hanau Engineering Company, Buffalo, N. Y.
19. HANAU, R. L.: Articulation defined, analyzed and formulated. *J. Am. Dent. A.* 13: 1694-1707, 1928.
20. HARRIS, J. D.: Auditory acuity in severe aerotitis media. *Jour. Acous. Soc. Amer.* 17: 139-143, Oct. 1945.
21. HARVEY and MORANT: Flying personnel research committee, Royal Air Force, Minutes of the 12th Meeting of the Otological Committee, 18 May 1945.
22. JONES, E. H.: Irradiation of nasopharynx in office practice. *Arch. Otolaryng.* 37: 436-438, Mar. 1943.
23. KELLY, W. J.: An evaluation of a dynamic concept of dental treatment based upon a functional classification of malocclusion. Research Project, Bureau of Medicine and Surgery, U. S. Navy, 15 Feb. 1946.
24. KELLY, W. J. and LANGHEINZ, H. W.: Dental treatment for prevention of aerotitis media. *Ann. of Otol., Rhin., and Laryng.* 55: 13-28, 1946.
25. LOWRY, R. A.: Loss of intermaxillary distance; effect on aviators and relief by interdental splint. *U. S. Nav. M. Bull.* 37: 367-380, July 1939.
26. MCGIBBON, J. E. G.: Aviation pressure deafness. *J. Laryng. & Otol.* 57: 14-22, Jan. 1942.
27. MONSEN, G. S.: Applied mechanics to the theory of mandibular movements. *Dent. Cos.* 74: 1039-1053, 1932.
28. POPPEN, J.-R.: Ear in flying. *Laryngoscope* 51: 974-982, Oct. 1941.
29. Relationship of dental malocclusion to ear blocks in the low pressure chamber. From the Dental Dept. and Physiology Research Section, U. S. Naval Air Training Center, Pensacola, Fla., 1944.
30. RENTSCHLER, H. D. and SETTLE, J. W. Jr.: Treatment of impaired hearing by radiation of excessive lymphoid tissue in the nasopharynx. *Pennsylvania M. J.* 47: 985-988, July 1944.
31. RICH, A. R.: Physiological study of eustachian tube and its related muscles. *Bull. Johns Hopkins Hosp.* 31: 206, June 1920.
32. SCHENCK, H. P.: Influence of nasopharyngeal hyperplasia on ear; histologic examination of hyperplastic lymph follicles after irradiation. *Laryngoscope* 51: 780-790 Aug. 1941.
33. SIMPSON, J. F.: General survey of otorhinological considerations in service aviation. *J. Laryng. & Otol.* 57: 1-7, Jan. 1942.
34. TEED, R. W.: Factors producing obstruction of auditory tube in submarine personnel. *U. S. Nav. M. Bull.* 42: 293-306, Feb. 1944.
35. WILLHELMY, G. E.: Ear symptoms incidental to sudden altitude changes and factor of overclosure of mandible; preliminary report. *U. S. Nav. M. Bull.* 34: 533-541, Oct. 1936.

RADIUM THERAPY IN AEROTITIS MEDIA

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Among the newer therapeutic measures before the war that have been used with beneficial effect in the service has been the irradiation of the region of the pharyngeal orifices of the eustachian tubes in aviation personnel to relieve obstruction to satisfactory aeration of the middle ears. Since Crowe (1) first used radium in the nasopharynx to diminish the hyperplastic lymphoid tissue and thereby provide better aeration of the middle ears in the treatment of deafness in children, this application of radium therapy has been used by many clinicians with advantage in relieving obstruction to aeration of the middle ears caused by lymphoid tissue about the orifices and in the eustachian tubes which is inaccessible for surgical removal. With this experience, it was natural to envisage its usefulness as a preventive treatment of aerotitis media, the most common physical ailment among aviators.

CONDITIONS ALTERED IN THE MIDDLE EAR AND SINUSES BY ALTITUDE (2)

Being bony cavities, the air spaces of the skull represented by the middle ears and nasal accessory sinuses do not increase or decrease in size to avoid the ill effects of the expansion and compression of the air they contain resulting from the changes in atmospheric pressure experienced in flying. Therefore, free exchange of the air in the middle ear through the eustachian tube and of the air in the sinuses through their openings is essential to an aviator's well-being. Table 1, showing the approximate values, enables one to readily understand the importance of this free exchange of air if discomfort and damage to the ears are to be prevented. It should be borne in mind that it is not the variation in the atmospheric pressure and the gas volume or its composition that in themselves cause ill effects, but the inequality of the pressure effects existing between the air in the middle ears and sinuses and in that in their surroundings. As one would probably reason, these effects of atmospheric changes occur more frequently in descent since this is relatively faster than ascent. Although in general this is true, the amazing speed of some military aircraft enables

such rapid ascent that pilots suffer from aero-embolism unless protective measures are taken.

The ill effects on the ears in ascent, however, have been rare as compared with those in descent. The cause for this in many cases might well be that the form of the eustachian tube permits egress of the increasing volume of air in ascent from the middle ear more readily than it does the ingress of air to compensate for the decreasing volume of air on descent. It is a common observation that increasing the barometric pressure, whether on descending in an airplane or in a low-pressure chamber, frequently causes ear symptoms from lack of normal patency of the eustachian tubes. Equalization of pressure may be maintained in most cases through yawning, swallowing, moving the lower jaw horizontally with the mouth open, or holding the nostrils closed and increasing the air pressure in the nasopharynx by swallowing. The Valsalva technique may not be effective if it is not begun until after the symptoms of tubal obstruction have passed the mild stage.

TABLE 1.—*Comparative volumes of the gastro-intestinal gases at various altitudes*

Altitude	Atmospheric pressure	Gas volume
<i>Feet</i>	<i>mm. Hg</i>	
0	760	1.0
8,000	564	1.5
18,000	380	2.0
27,000	258	3.0
34,000	187	4.0
40,000	141	5.5

AEROTITIS MEDIA

Failure to be able to ventilate the middle ear adequately results in observable changes in the drum membrane. The variations from the normal may be simply a retraction of the drum and a redness along the handle of the malleus, with sensations ranging from a mild degree of stuffiness to that of severe pain when the drum is red and bulging from extravasation of blood or serum into the middle ear. Even if a drum membrane is fiery red and bulging following a flight, it is unwise to do a myringotomy, unless there is other evidence of infection, because of the dangers of introducing an infection by the treatment prescribed. Extravasation of blood into the external canal does not alone warrant the diagnosis of a ruptured ear drum. Bleeding may occur within the drum membrane forming blebs that may rupture internally into the middle ear or externally into the canal without producing a perforation. In a report, Silberstern (3) cited 12 cases of hemorrhages into the tympanum in caisson workers without men-

tioning a single case of complete rupture of the drum. Schilling and Everley (4) in a comprehensive report on their observations on personnel examined after low-pressure tank tests, stated, "* * * blood has been noted coming from the external canal or from the eustachian tube, and upon examination, no complete perforation could be demonstrated." The foregoing observations are important because it is such common practice to accept a bulging red drum membrane as an indication for myringotomy and also that the presence of blood in the external canal along with a red drum membrane is the result of a complete rupture of the drum.

Conservative measures in the care of such acute ear conditions are the most helpful. If the patient cannot inflate his ears easily by the Valsalva method, it is not advisable to attempt to inflate them through a catheter. Astringent drops or sprays in the nasopharynx are usually effective. When there is an upper respiratory infection, no attempt should be made by any method to inflate the ears, but active treatment of the infection should be carried out. If there is blood in the external canal, irrigations should not be done because of the danger of causing a middle ear infection if the drum is completely ruptured. General measures should be taken to avoid infection of the ears including, in the severe cases, the use of penicillin and if not available, sulfonamides. The symptoms of acute aerotitis media usually subside within a few days and then suitability of the patient for radium therapy is to be considered.

RADIUM THERAPY

The relatively high sensitiveness of lymphoid cells to radiation therapy, in itself, is a recommendation for its usefulness because the dosage necessary is not sufficient to hazard adjacent tissue cells to the disintegrative effects of radium. Radium therapists are in accord that leukocytes, especially the lymphocytes, and tumors composed chiefly of lymphocytes are the most sensitive and retrogress rapidly after exposure to radium rays. The initial observation on this great sensitivity of lymphoid tissue was made some 40 years ago (5), and has been confirmed by other investigators (6). Although this high degree of sensitivity is recognized in which the cells disintegrate rapidly with destruction of young lymphocytes and, to a lesser extent, changes in the adult type, a considerable capacity has been observed for regeneration of germinal follicles within a few months (7). This effect has been observed by Crowe and Burnam (9) in the treatment of eustachian tube obstruction in children with impaired hearing which in some cases required treatment over a long time to control the proliferation of lymphoid tissue. When a large mass of adenoids (pharyngeal tonsil) is found in the midline on examination, surgical

removal is recommended as a preliminary treatment before radium therapy.

One may expect a diminished natural tendency in progressive age groups for a tendency for regeneration of lymphoid tissue in the nasopharynx, but one of the aviation personnel in the group reported here, a navigator on a commercial line before the war, had received radium therapy in 1940 and was not plagued thereafter with symptoms of aerotitis media until 3 years later. Again he was relieved by radium therapy which would seem to indicate a regeneration of the obstructing lymphoid tissue in the nasopharynx.

The technique of using radium therapy in the nasopharynx is simplified by the development of an applicator only slightly larger than the ordinary metal nasal applicator that has enclosed in its distal end in a Monel metal tubular chamber either radium emanations (radon) or radium. Initially the nose and nasopharyngeal regions should be

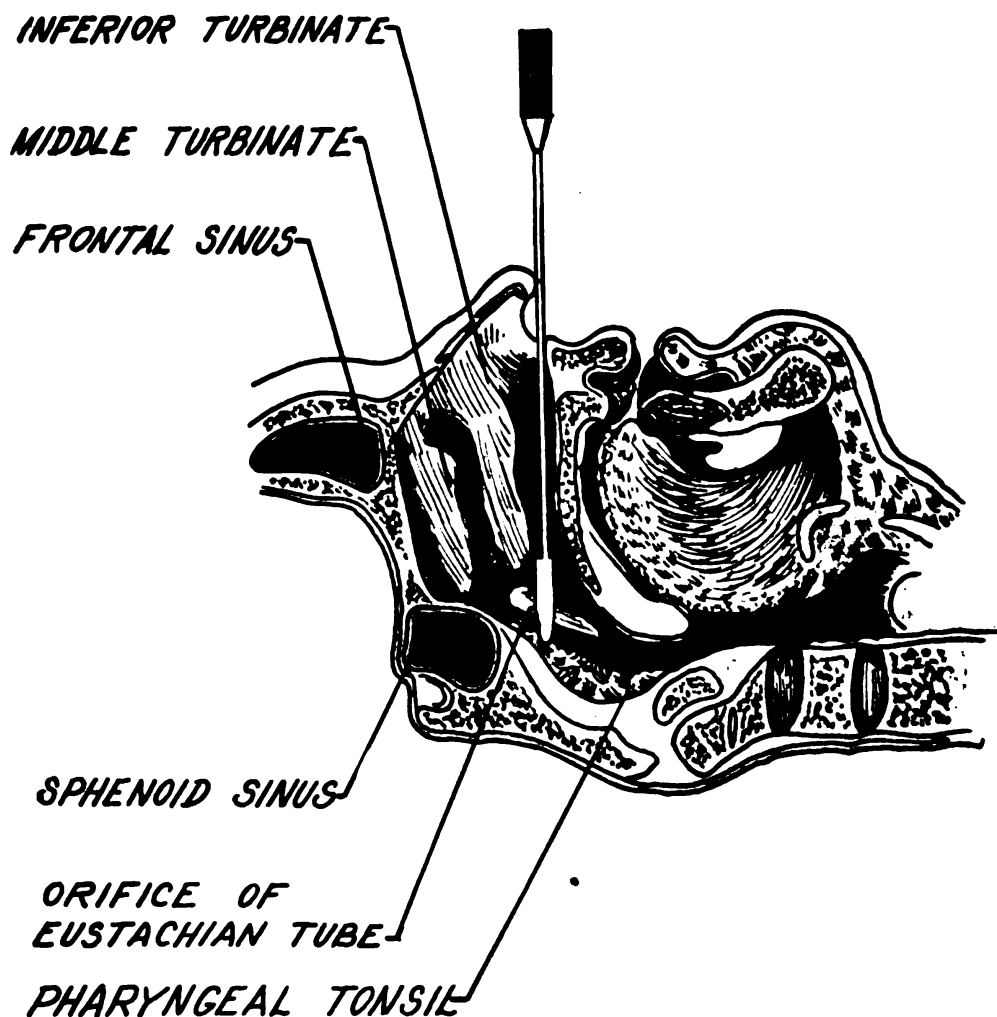


FIGURE 1.—Applicator inserted in nasopharynx, patient in recumbent position.

anesthetized so as not to cause any discomfort by the treatment. This can be done by first spraying the nose lightly with 2-percent cocaine solution and soon following by passing a cotton tipped nasal applicator saturated with 10-percent cocaine solution along the inferior meatus to the posterior pharyngeal wall and leaving it in position for 5 minutes. When a septal ridge or other obstruction prevents the free passage of an applicator through the inferior meatus, more effective astringents should be used to supplement cocaine. The Monel metal tubular chamber is 15 mm. in length, with an inside chamber of 1.7 mm., a wall thickness of 0.3 mm., and an outside diameter of 2.3 mm. The radon applicator has the disadvantage of rapid decay by which its strength is reduced one-half in 3.85 days. It is economical however, if only an occasional case is to be treated. On the other hand, the radium applicator (50 mg.), although representing a considerable initial cost, retains its life almost indefinitely and can be used daily without increasing the time of exposure to meet the required dosage.

The radium applicator has been used in most of the cases treated and the dosage commonly used has been 3 gram minutes to each side which requires 6 minutes and 40 seconds continuous application, using two applicators, one on each side, resting in the immediate region of the pharyngeal orifices (fig. 1) of the eustachian tubes. Since the effectiveness of radiation therapy is within a circumference with a radius of 20 mm. of the distal part of the applicator containing radium, it is essential that the area to be radiated should be within that limit.

The most accurate procedure is to place the radium applicator in the desired location under visual observation through a nasopharyngoscope in the opposite naris and secure it against the nasal septum with a clamp or by packing the anterior portion of the naris with cotton. Since this procedure requires the operator to place his eyes not far distant from the radium end of the applicator, it is not considered without an element of danger to him in the repeated use required on treating a considerable number of patients. The alternate procedure of using the radium applicator is to pass it along the floor of the nose until the distal end impinges against the posterior pharyngeal wall, the distance having been previously measured under observation through the nasopharyngoscope. The most common error is to get the distal end of the applicator too high in the nasopharynx.

The spacing of the interval between treatments to 4 weeks is to permit recovery of the tissues from the reaction caused by the previous treatment, which should be delayed if an acute upper respiratory infection exists. Variations both anatomically and in responsiveness in different patients treated preclude rigid standardization of the number of treatments that may be considered as adequate. A routine

of three treatments as recommended by Crowe (10) is the minimum used, which may be supplemented if satisfactory results are not obtained.

The following precautionary measures as used by Crowe are recommended as a routine procedure:

1. Leave the applicator in the lead cylinder until ready to insert it into the patient's nasopharynx. A lining tube of glass may be fitted into the hole in the lead cylinder and kept filled with 95 percent alcohol, which is a convenient means of sterilizing the applicator. Heat must never be used.
2. Wear rubber gloves. Three mm. of rubber absorbs approximately 75 percent of the beta rays and thus helps to protect the hands.
3. The patient should lie comfortably on a couch during the treatment.
4. Use the interval-timer clock to control the duration of the treatment.
5. Remove the applicator from the lead cylinder, wash off the alcohol with water, dip into a lubricant (one that is water-soluble and may be quickly washed off at the conclusion of the treatment) and insert into the nasopharynx.
6. Exact placing of the applicator is most important. The nasopharynx varies in size. The middle (not the end) of the radium-containing chamber should be in direct contact with the tissue in the fossa of Rosenmueller or the orifice of the eustachian tube. The exact location and depth from the external nares to the area to be treated can be determined only by a preliminary examination with the nasopharyngoscope in one side of the nose and a calibrated rod or dummy applicator in the opposite side. Never bend the applicator in order to put it in the eustachian tube, since this may lead to leakage of radon. When in place, fix it with a suitable clamp or adhesive.
7. The most important protection for personnel using the treatment is distance. The intensity of the radiation varies inversely with the square of the distance. At a distance of 1 foot, the radiation is $1 \times 1 = 1$, which is called unity. At 10 feet, $10 \times 10 = 100$, and the intensity is $1/100$ of what it is at 1 foot. At 20 feet, $20 \times 20 = 400$, and the intensity is reduced to $1/400$ of what it is at 1 foot. During the treatment, all personnel who are constantly handling the applicator should be at a distance of 25 or 30 feet.
8. At the conclusion of the treatment, the mucus adhering to the applicator should be removed with a brush fixed to the table or sink and quickly replaced in the lead cylinder. A radium-carrying chamber at the end of the applicator must never be touched. If the applicator is repeatedly cleaned by wiping it with gauze held in the hand, radiation changes will soon become evident in the skin and nails.

If the precautions outlined are followed, there is no danger to the hands or fingers. The applicator should always be held at the end of the handle and away from the body. The placing of the applicator should be done rapidly and when treatment is completed, the applicator should be put back into the cylinder immediately.

Personnel who had only slight "clogging" of the eustachian tubes that could be inflated easily by the Valsalva technique were not treated. In the 60 cases reported here, none was of personnel treated until after primary and secondary training in aviation, and all were operating in a temperate zone where weather conditions were not particularly con-

ductive for upper respiratory infection. Some of them with considerable time in aviation had not been subjected to high altitude effects. A majority of the personnel treated had from 500 to 1,000 hours flying time at an altitude rarely over 15,000 feet and had experienced no great difficulty with ear symptoms. A few, however, had been in aviation several years and had suffered irreparable damage to their hearing, resulting in a lowered flying classification or in being grounded. Thirty-two had moderate symptoms of aerotitis media on low pressure chamber runs or in flight; 19 had moderate to severe symptoms of aerotitis media on low pressure chamber runs or in flight; and 9 had severe symptoms of aerotitis media in flight.

Audiometric tests were done at some time after the acute stage of aerotitis media had subsided and repeated 4 weeks following the last radium treatment. The results in providing better ventilation of the ears when subjected to changes in atmospheric pressure were satisfactory in the 90 percent of the cases that received adequate treatment and were followed up, and usually there was improvement in hearing acuity if it was a recently acquired defect. Although there was no appreciable restoration of hearing in those where the loss had existed for a long time, the better aeration of the ears brought about by treatment probably lessened the further deterioration of hearing to be expected in such cases.

Aviators today are largely protected from the hazards to hearing that formerly were inevitable when they were subjected to the intense noises of the propeller blasts and motors in open-cockpit airplanes, but speedier flying and flying at higher altitudes has increased the cases of ear damage from aerotitis media. In four of the cases there was a hearing loss of from 40 to 50 decibels in one or both ears. These officers had suffered repeatedly with aerotitis media, usually in a mild form, before experiencing severe attacks with bleeding from the ears which was followed by infection (12). It may well be that their greatest usefulness as flight personnel could have been prolonged if treatment had been given in the early stages of the recognition of lack of patency of the eustachian tubes.

COMMENT

Symptoms of aerotitis media may occur early in training at low-altitude flying or in low-pressure chamber runs made to simulate various altitudes or later during operational training when higher-altitude flying is experienced with rapid changes in atmospheric pressures made in dive bombing and fighting maneuvers. Eustachian tube blockage that produces only mild ear symptoms at low altitudes may be disabling in high flying and rapid changes in altitude, with the

severity of the symptoms intensified in the presence of an upper respiratory infection. Fowler (13) noted that during the winter in England, upper respiratory infections in American soldiers were more frequent than in the United States and 22 percent of the flying personnel examined by him had a history of recent otitis, of which most of them had sufficient excess of lymphoid tissue around their eustachian tubes to account for their disability. Some of our airmen, he stated, went to Africa and were free of ear symptoms until they came back and the results of irradiation of the lymphoid tissue in the nasopharynx in relieving obstruction to the eustachian tubes have been encouraging.

In the use of radium therapy, it must be decided where facilities should be made available considering the advisability of instituting treatment simply from the size and distribution of lymphoid tissue in the nasopharynx found on examination before or early in flight training, or of waiting until symptoms of aerotitis media appear either in low-pressure chamber tests or in actual flight. Although no harm can be thought of that would come from treatment with radium being used in those cases where the size and distribution of lymphoid tissue appear to offer an indication for such, experience in examination of the nasopharynx in aviation personnel as well as in clinical practice is convincing that any prediction made of symptoms developing based on such anatomical variations from the normal frequently are erroneous. No lasting damage to one's ears and no modification in an aviator's career are likely to occur, if care is taken to provide treatment for those who have more than the mildest "clogging" of the eustachian tubes either on the low-pressure chamber tests or while in flight training. Since treatment with radium may not give lasting satisfactory results, patients will be well informed if advised of the necessity for repeating the treatments if recurrence of symptoms of aerotitis media is experienced.

Such uncommon conditions causing eustachian-tube obstructions and requiring specific treatment as purulent sinusitis, polyps, neoplasms, cysts, paralysis, scar tissue, or dental malocclusion will have been disclosed on the preliminary examination. My experience does not warrant considering obstruction to nasal breathing from a deflected nasal septum or hypertrophy of the turbinates as appreciably interfering with ventilation of the middle ears. As an example, a child patient, 7 years of age, who had imperforate choanae prohibiting nasal breathing throughout life was found to have normal hearing and no symptoms that might be attributed to lack of patency of the eustachian tubes. In cases with dental malocclusion, temporary means of opening the bite and the results noted are advisable before considering permanent dental restoration or correction.

CONCLUSIONS

1. Failure to maintain an equal degree of atmospheric pressure on the inner and outer sides of the ear-drum membrane is the cause of aerotitis media, the most common ailment experienced in flying.
2. Satisfactory preventive treatment of aerotitis media in those susceptible adds to the comfort, proficiency and duration of service of aviators.
3. The effectiveness of radium therapy in relieving lymphoid tissue obstruction to the eustachian tubes recommends it as the treatment of choice.

REFERENCES

1. CROWE, S. J.: Recognition, treatment and prevention of hearing impairment in children. *Laryngoscope* **50**: 658-662, July 1940.
2. NORTHINGTON, P.: Otolaryngologic problems of aviation. *New York State J. Med.* **44**: 1655-1660, August 1, 1944.
3. SILBERSTERN: *Oesterr. Vrtljschr. f. Gesundheitspflege, Wien* **3**: 263. 1912.
4. SCHILLING, C. W. and EVERLEY, I. A.: Auditory acuity in submarine personnel. Part III. *U. S. Nav. M. Bull.* **40**: 664-686, July 1942.
5. HEINKE, H.: Ueber die Einwirkung der Röntgenstrahlen auf Tiere. *München. med. Wchnschr.* **50**: 2000-2002, December 1903.
6. DESJARDINS, A. U.: Radiotherapy for inflammatory conditions. *J. A. M. A.* **96**: 401-408, February 7, 1931.
7. HOLTHUSEN, H.: Die allgemeine-biologische Wirkung der Röntgenstrahlen. *Strahlentherapie* **62**: 228-239, 1938.
8. SCHENCK, H. P.: Histopathological changes occurring in chronic infection of pharynx. *Ann. Otol., Rhin. & Laryng.* **50**: 817-833, September 1941.
9. CROWE, S. J. and BURNAM, C. F.: Recognition, treatment and prevention of hearing impairment in children. *Ann. Otol. Rhin. & Laryng.* **50**: 15-31, March 1941.
10. AERO-OTITIS CONTROL PROGRAM. Headquarters, Army Air Forces, Washington, 18 December 1944 (AFTAS).
11. ARMSTRONG, H. G.: *Principles and Practices of Aviation Medicine*. William Wood & Co., Baltimore, Md., 1939.
12. WRIGHT, R. W.: Aerotitis media; further report of purulent otitis media complicating aerotitis media, *Ann. Otol. Rhin. & Laryng.* **54**: 499-512, September 1945.
13. FOWLER, E. P., Jr.: Use of radon to prevent otitis media due to hyperplasia of lymphoid tissue and barotrauma (aerotitis). *Arch. Otolaryng.* **40**: 402-405, November 1944.

THE SIGNIFICANCE OF HANGER'S TEST (CEPHALIN-CHOLESTEROL FLOCCULA- TION TEST) IN DISORDERS OF THE STOMACH AND COLON

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This study was undertaken with the idea of determining the role of the liver during chronic gastro-intestinal disturbances in which there was considerable loss of body fluids and minerals.

One group of patients consisted of gastroscopically established chronic gastritides and roentgenologically positive peptic ulcers.

The second group, which was composed of diarrheas due to large bowel involvement, was divided into several subgroups, such as ulcerative colitis; lower bowel infestations with *Giardia lamblia*, *E. Nana*, and *E. Coli*; the third subgroup was composed of nonspecific diarrheas of longer than 2 years' duration; the final subgroup was amebiasis. As a control, we used orthopedic cases without any history of digestive complaints.

In the first group of chronic gastritides and peptic ulcers, we had 27 patients, 11 of whom had positive Hanger's tests. The highest positive strength was 2 plus. The percentage of positive Hanger's tests was 41.

The lower-bowel group numbered 47, out of which the total positive Hanger's tests were 32. The highest positive strength of the Hanger's test was 4 plus, and the total positive percentage was 68.

We had 8 patients with ulcerative colitis, and the total positive Hanger's tests numbered 7. The highest positive strength was 3 plus, and the total percentage of positives was 87½.

There were 5 lower-bowel infestation patients. The total positive Hanger's tests numbered 3. The highest positive strength on the tests was 2 plus. The percentage positive was 60.

The total number of nonspecific diarrheas was 21. These were mostly psychosomatic cases with irritable colons. The total positives for the Hanger's tests were 14. The highest positive strength was 3 plus. The percentage of positives was 66⅔.

The total number of patients with amebiasis without obvious liver abscess demanding surgical intervention was 12. The total positive Hanger's tests were 10. The highest positive strength was 4 plus, and the percentage positive was $83\frac{1}{3}$.

There were 38 orthopedic controls, in which the number of positives was 5, and the highest positive strength was 2 plus. The percentage of positive controls was 18.

COMMENT

This study opens a field of physiologic speculation. One wonders why should conditions which directly are involved in the digestive processes result in less of the liver impairment than the cases of large bowel involvement, which, as far as it is known up to now, physiologically has less to do with the digestion of foods and which is therefore apt to be less damaging to the substance of the liver. It is felt by the authors that the damage of the liver is secondary to the impairment of the stomach and the intestine. Only in cases of amebiasis the toxins thrown off by *E. histolytica* may cause the damage of the liver first and result in colitis secondly. It is the opinion of the authors that the colon is connected somewhat with the nitrogenous balance of the body, and its physiologic imbalance causes damage to the liver. The analysis of the 18 positives of the control orthopedic patients points out that even in normal individuals with little or no digestive complaints the liver may be involved to some degree, but the percentage is strikingly lower compared with the percentage in gastro-intestinal cases.

In conclusion, the old country doctor's saying to the patient that he may be bilious and his liver may be involved is not far from reality, as demonstrated above by the Hanger's test. The precautions for the Hanger's tests are that they have to be performed by skilled personnel, and the tubes have to be kept in darkness and at a temperature of 37.5° F.

SUMMARY

1. Hanger's test was positive in :

- 87 $\frac{1}{2}$ percent of patients with ulcerative colitis,
- 83 $\frac{1}{3}$ percent of patients with amebiasis,
- 66 $\frac{2}{3}$ percent of patients with nonspecific diarrheas,
- 41 percent of gastritides and peptic ulcers, and
- 18 percent of orthopedic controls with no digestive disorders.

2. Properly performed Hanger's tests are an important diagnostic procedure to determine latent involvement of the liver, especially in disorders of the digestive tract.

REFERENCES

1. ROSENBERG, D. H.: Cephalin-cholesterol flocculation test in cases of disease of liver, with special reference to diagnosis of mild and unsuspected forms. *Arch. Surg.* 43: 231-248, August 1941.
2. ROSENBERG, D. H. and SOSKIN, S.: Comparison of cephalin-cholesterol flocculation test with various criteria of liver function (with note on significance of hyperexcretion of hippuric acid). *Am. J. Digest. Dis.* 8: 421-432, November 1941.
3. POHLE, F. J., and STEWART, J. K.: Cephalin-cholesterol flocculation test as aid in diagnosis of hepatic disorders. *J. Clin. Investigation* 20: 241-247, May 1942.
4. NADLER, S. B. and BUTLER, M. F.: Cephalin-cholesterol flocculation test in jaundiced patient. *Surgery* 11: 732-738, May 1942.
5. LAWSON, E. H., and ENGELHARDT, H. T.: Cephalin-cholesterol flocculation as liver function test. *New Orleans M. S. J.* 95: 60-62, August 1942.
6. KIRSCHNER, P. A., and GLICKMAN, S. I.: Cephalin flocculation test in jaundice. *J. Lab. & Clin. Med.* 28: 1721-1724, November 1943.
7. SALMON, G. W., and RICHMAN, E. E.: Liver function in newborn infant. *J. Pediat.* 23: 522-533, November 1943.
8. MATEER, J. G., BALTZ, J. I., MARION, D. F., and HOLLANDS, R. A.: Comparative evaluation of newer liver function tests (comparison of intravenous hippuric acid test, cephalin-cholesterol flocculation test, colloidal gold test and serial bromsulphthalein test). *Am. J. Digest. Dis.* 9: 13-29, January 1942.
9. MATEER, J. G., BALTZ, J. I., MARION, D. F., and HOLLANDS, R. A.: Cephalin-cholesterol test for liver function. *Gradwohl Laboratory Digest* 4: 11, 1940-1941.



STIMULATING RADIOTHERAPY OF THE PANCREAS AS A TREATMENT OF DIABETES MELLITUS

"Irradiation with x-rays was administered to 12 patients with moderate to severe diabetes. The distance of the focus from the skin was 25 cm. A filter of Cu and Al was used. The doses given twice weekly varied between 50 and 150 roentgens. In 50 percent of the patients a reduction in glucosuria was obtained with absence of acetonuria. The fasting blood sugar increased moderately in 4 patients and decreased in the others. The residual chronic index increased in 3 cases, decreased in the others and arrived in 6 at normal values. The double glucose test showed generally a tendency toward a normalization of the curve. The general conditions considerably improved in 6 patients."—SOLER, C. B., PALLARDO, L. F., CALVIN, J., and PIGA, A.: Stimulating radiotherapy of the pancreas as a treatment of diabetes mellitus. *Chem. Abst.* 40: 1185, March 10, 1946.

NEUROSURGERY ON BOARD AN ATTACK TRANSPORT (HOSPITAL)

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The reduction of mortality and morbidity among neurosurgical casualties, especially craniocerebral and scalp wounds, by the use of mobile "centers" to provide early specialized care has received considerable attention in the literature (1) (3). During the early phases of an amphibious operation, and indeed for a considerable period where naval casualties are concerned, the only comparable facility available for the treatment of such cases are those attack transports (APA) or attack transports (hospital) (APA-H) participating in the action which carry a neurosurgeon.

It is obviously impossible to provide a neurosurgeon for each such ship taking part in the operation, and furthermore the number of neurosurgical cases usually received by any one ship would hardly justify this. Some attempt has been made to indicate the ship or ships carrying a neurosurgeon or other surgical specialists and in this manner the majority of patients requiring specialized care have usually reached such hands eventually. However, this has not always been the case and sometimes the delay in effecting transfer has been such as to be detrimental to the best treatment.

It is the purpose of this article to illustrate the manner in which a fairly large group of neurosurgical casualties has been handled on aboard an attack transport (hospital) (APA-H), to point out the advantages of caring for such cases in this way, and to suggest the specific designation of such a ship as a "center" for the treatment of such cases during amphibious combat.

CLINICAL MATERIAL

During a 66-day period 90 neurosurgical casualties were handled on board an attack transport (hospital) standing off Okinawa. These represented 5.8 percent of the total cases received by this ship.

There were 68 craniocerebral injuries, 5 injuries to the spinal cord, 3 to the cauda equina, and 14 to peripheral nerves (table 1). Of the craniocerebral injuries, 43 were of the closed type, 30 of these being complicated by scalp wounds; there were 5 compound skull fractures.

3 depressed skull fractures, 14 penetrating wounds of the skull and brain, one subdural and one extradural hematoma, and one subdural hydroma.

Forty-seven operations were performed on these patients (table 2). Nine of these were for penetrating wounds, 3 for depressed fracture, 5 for compound fracture, 2 for intracranial hemorrhage, and 1 for subdural hydroma. One decompression and 19 scalp debridements were done. Three laminectomies were performed and in 4 instances operations were done for peripheral nerve lesions.

The 5 penetrating wounds which were not operated upon on board ship were taken on during the latter phases of the action and had already received surgical treatment ashore.

Only 2 patients died on board. In one the cause of death was peritonitis and in the other multiple extreme injuries. One patient is known to have died after leaving the ship enroute to a rear area; in this case the cause of death was breakdown of an intestinal anastomosis. In each of these instances the craniocerebral wounds were healed and autopsy revealed nothing intracranial which would have contributed to the death of the patient. Of course, it is obvious that the usual 20 percent of patients with penetrating craniocerebral wounds who die of brain damage (1) either did not reach the ship or were not represented in this small group.

FACILITIES AVAILABLE FOR TREATMENT

The striking fact emerging from this experience was that it was possible for the neurosurgeon to work under conditions approaching those of a modern hospital. Furthermore, it seemed evident that slight improvements would render the facilities essentially equal to those available at any base hospital.

There were adequate operating rooms with modern operating tables and lighting. A complete kit of neurosurgical instruments was available. This included lighted brain retractors which were used to advantage on several occasions. Two types of suction were available, motor and water-pump; both of these proved adequate for use in neurosurgery.

An electrocautery was provided. This was not, of course, as satisfactory as a regular electrosurgical unit which undoubtedly would have saved time in obtaining hemostasis. Fibron foam would likewise have been helpful in this respect. X-ray facilities were adequate for ordinary purposes. There were some instances, however, in which stereoscopic views would have been helpful, had the equipment for obtaining these been provided.

A blood bank was maintained on board ship and this was put to good use. There was an adequate reserve of penicillin and it was employed parenterally in every case and locally in one or two cases. No local sulfonamide was used.

Clean, reasonably accessible bunks were available for the care of patients with closed head injuries and for postoperative care. Proper diet, freedom from mud and vermin, and protection from enemy fire were certainly important factors in hastening convalescence. Blood and intravenous therapy could easily be administered, tidal drainage provided when indicated in cord cases, and suction immediately employed to keep the air passages clear.

Under the conditions described it was possible to give immediate definitive treatment. The importance of this is realized when Cairn's (1) report of British experiences in North Africa and France are considered. He has shown that early debridement and closure results in primary healing in 90 percent of craniocerebral wounds, and that the development of brain abscess and meningitis occurs in 25 percent of patients with penetrating wounds of the brain when initial operative treatment is not thorough, but can be almost entirely eliminated when it is. In the present series of cases primary healing was obtained in all but one instance; this patient pulled off his dressing and dug his nails in the scalp wound with the result that it became secondarily infected and broke down.

Scalp wounds were healing well with sutures out in 4 days after excision and closure in two layers, whereas cases received as long as 9 days after injury where debridement had not been done were in many instances unhealed and infected. The importance of careful surgical treatment of these wounds in reducing the morbidity among neurosurgical patients has received repeated emphasis in the literature (2) (5) (1) but the matter is still not given sufficient attention by the average medical officer.

DISCUSSION

There has been general agreement that early specialized and definitive treatment has been the most important factor in the reduction of mortality and complications in neurosurgical cases in this war (1) (7). Chemotherapy has been a useful adjunct and indeed has made it practicable to carry out thorough operative treatment in many instances much later than would have been possible without it. However, it is no substitute for adequate surgery (4) (6).

The excellent results which have been achieved have been reported almost exclusively from land operations where the mobile unit or center could operate just behind or near the front lines. The same

conditions, however, do not obtain during amphibious combat. A "center" cannot function on a beachhead nor can every attack transport (APA) be provided with the necessary personnel and equipment to carry out the specialized treatment required. The Army Field Hospital and Marine Medical Battalion can provide adequate facilities after the landing forces have pushed inland, but until such time as these can be set up, a properly manned and equipped ship standing off-shore is in a position to provide the best possible care.

As far as naval neurosurgical casualties are concerned, the usefulness of such ship-borne "center" is even greater. Hospital ships (AH) do not carry neurosurgeons, nor do they come up until the heaviest losses are over. Weeks often elapse before a base hospital is set up ashore. During this time a ship "center" would be in a position to best provide for neurosurgical casualties, and the employment of a *specialist ship* to care for them, possibly in conjunction with other specialized cases, such as thoracic and abdominal injuries, is accordingly suggested.

SUMMARY AND CONCLUSIONS

1. The care of 90 neurosurgical casualties, 47 of them operative, on board an attack transport (hospital) (APA-H) is described in order to illustrate the manner in which such cases can be handled aboard ship during amphibious combat.

2. The facilities available are described and compared favorably to modern hospital conditions.

3. It is pointed out that the reduction of mortality, morbidity, and complications in neurosurgical casualties achieved through early specialized care by mobile units in the field can be paralleled aboard ship under amphibious-combat conditions.

4. It is suggested that during amphibious combat a *specialist ship* be provided to act as a "center" for care of neurosurgical casualties and other injuries requiring specialized care; this ship "center" to remain available until shore activities are established with comparable facilities for handling such cases from both land and naval forces.

TABLE 1.—*Classification of cases*

Cerebral injury.....	43
Without open wounds.....	13
With scalp wounds.....	30
Wounds of skull:	
Without depression of fragments.....	5
With depression of fragments but without dural penetration.....	3
Wounds of skull and brain with dural penetration.....	14
Subdural hematoma.....	1
Extradural hematoma.....	1
Subdural hydroma.....	1
Spinal cord injuries.....	5
Cauda equina injuries.....	3
Peripheral nerve injuries.....	14
Total	90

TABLE 2.—Operations performed

Craniotomies for penetrating wounds of the skull and brain	9
Craniotomy for intracranial hemorrhage	1
Debridement of compound skull fractures	5
Removal of depressed skull fragments	3
Evacuation of subdural hematoma	1
Evacuation of subdural hydroma	1
Subtemporal decompression	1
Scalp debridements	19
Laminectomies	3
Operations for peripheral nerve injuries	4
Total	47

REFERENCES

1. CAIRNS, H.: Gunshot wounds of head in acute stage. *Brit. M. J.* 1: 33-37, January 8, 1944.
2. BOTTERELL, E. H. and JEFFERSON, G.: Treatment of scalp wounds in air-raid and other casualties. *Brit. M. J.* 1: 781-783, June 27, 1942.
3. EDEN, K.: Mobile neurosurgery in warfare; experiences in Eighth Army's campaign in Cyrenaica, Tripolitania and Tunisia. *Lancet.* 2: 689-692, December 4, 1943; also, *Brit. J. Surg.* 31: 324-328, April 1944.
4. EVERTS, W. H. and WOODHALL, B.: Management of head and spinal cord injuries in the Army. *J. A. M. A.* 126: 145-148, September 16, 1944.
5. HORRAX, G. and COLEMAN, C. C.: Gunshot and other injuries of scalp, skull, and brain. In *Neurosurgery and Thoracic Surgery (Military Surgical Manuals, VI)*, prepared and edited by the Subcommittees on Neurosurgery and Thoracic Surgery of the Committee on Surgery of the Division of Medical Sciences of the National Research Council. W. B. Saunders Co., Philadelphia, 1943.
6. MELANEY, F. L.: Statistical analysis of study of prevention of infection in soft part wounds, compound fractures and burns with special reference to the sulfonamides. *Surg., Gynec. & Obst.* 80: 263-296, March 1945.
7. SCHWARTZ, H. G. and ROULHAC, G. E.: Craniocerebral war wounds; observations on delayed treatment. *Ann. Surg.* 121: 129-151, February 1945.



**INFLUENCE OF DIMETHYLAMINOETHYLBENZHYDRYL ETHER
HYDROCHLORIDE UPON HISTAMINE FLARE REACTIONS**

Author's summary.—Dimethylaminoethylbenzhydryl ether hydrochloride orally administered in sufficient amounts is capable of completely suppressing the sensitivity of the skin to histamine, at least as expressed by the wheal and flare reaction. In limited trials, this effect appears to have widespread clinical application.—ELIAS, H. and MCGAVACK, T. H.: Influence of dimethylaminoethylbenzhydryl ether hydrochloride upon histamine flare reactions. *Proc. Soc. Exper. Biol. & Med.* 61: 133-135, February 1946.

INFLUENZA ABOARD AN ATTACK TRANSPORT

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On July 19 1945 one case of influenza was admitted to the sick list aboard this ship in the Pacific theater of operations. By July 22 three more cases had been admitted and from that time on the ship was completely isolated from all contact with other ships and with the shore. Since a ship is one of the few self-sustaining communities in which this type of closed observation of an epidemic could be made this report may be of value in the epidemiology of the disease.

The ship's complement consisted of 49 officers and 443 enlisted men. All personnel had been aboard for about 8 months during which time the ship had been at sea. There had been no infectious diseases of consequence during this period and the health of the crew had been excellent.

Just prior to the onset of the epidemic there had been sporadic contact with the beach and ships in an area where influenza had been reported. The disease, therefore, was introduced into a fairly large and stable group, in a rather uniform condition of health, and in which there had been no recent opportunity to develop an immunity to any respiratory infection. The weather was hot and moderately rainy.

The influenza was typical of mild attacks everywhere. Initial symptoms were lassitude and aching followed by chilling and fever. There were no common respiratory symptoms except a dry hacking cough. There was a frequent but not unusual leukopenia, 52 percent being below 5,000 cells per cubic millimeter. Prostration was frequently severe and weakness was a pronounced sequel. Throat cultures were productive only of the usual organisms found in the mouth and no facilities for virus studies were available. The fever curve and pulse rate showed no typical pattern, with maximum temperatures of 103.5° F. and duration from 1 to 5 days. Treatment consisted of bed rest in a large isolation ward with high liquid, high carbohydrate intake and aspirin, phenacetin and caffeine p. r. n. for

relief of symptoms. The median duration of hospitalization was 6 days.

The graph shows the incidence of the disease. The upper columns show actual daily admissions. The lower figure represents in each column the admissions of the preceding 6 days. There were undoubtedly mild cases which did not come under the cognizance of the medical department, but these were few in number.

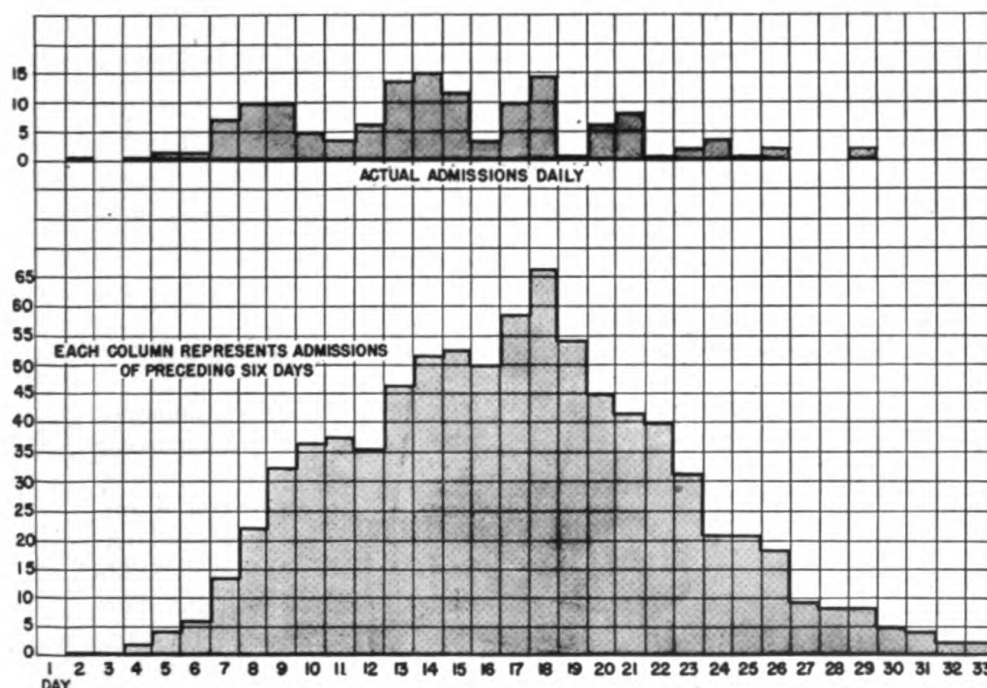


FIGURE 1.

Complications were few. The most alarming was a severe typical scarlet fever which developed on the fourth day of illness. Since there were no streptococcic infections prevalent a fair assumption is that the disease was contracted from a carrier. Because of the implication of influenza and hemolytic streptococcic infections existing simultaneously this patient was treated with penicillin. In spite of a temperature of 105.4° F. and severe symptoms the temperature was normal within 24 hours and continued so. No contact cases were observed.

Otitis media occurred in five cases. No bacteriologic examinations were possible since no ears were ruptured but the cases were clinically compatible with streptococcic infections. These were probably autogenous since other evidence of oronasal infections was lacking.

SUMMARY

In an epidemic of influenza aboard a ship at sea 30 percent of the crew was affected over a period of 30 days. There was no lack of exposure so it must be assumed that a degree of immunity exists in a high percentage of persons. Maximum exposure personnel (hospital corpsmen) and minimum exposure personnel (officers) had an almost identical percentage of illness.

In the absence of complicating infections, influenza of the same type occurring aboard this ship will probably behave in a similar manner on other ships. This is of military importance in anticipating the usefulness of units.



TRIAL OF SOLUTHIAZAMIDE IN THE TREATMENT OF LEPROSY

Soluthiazamide is p. (γ -phenyl-propylamine) phenyl-sulphamido-thiazole- β - γ -disulphonate of sodium. It is used in 45.3 percent solution, which contains 20 percent of thiazamide base. A 5-cc. ampoule contains 1 gm. of thiazamide. Most concentrated sulphonamides have a pH between 9 and 11.4 and this degree of alkalinity causes eschars; soluthiazamide has not this drawback. Trials with it for leprosy have been going on for 8 months; this is too short a time for a definite appraisal of its therapeutic value, but the results so far, as reported by the authors, are sufficiently promising to warrant more extensive testing.

Their clinical material comprised 100 cases, 50 with lepromata in a comparatively early stage and 50 adults with severe lepromatous forms and extensive involvement of the skin, in whom chaulmoogra had proved ineffectual. The drug was administered intravenously each day, except Sundays, for 3 weeks, the course being repeated after a week's interval; the initial dose was 1 cc., which was increased gradually to 5 cc. and in adults to 10 cc. Those receiving more than 5 cc. were given also an equal amount of glucose solution.

The results observed so far comprise: cicatrization of leprotic ulcers and of conglomerate lepromata, disappearance of lepromatous infiltrations and softening of subcutaneous nodules; perforating ulcers of the sole sometimes improved and ocular symptoms, after a brief period of exacerbation, showed considerable amelioration and had not relapsed during the time that patients were under observation; the nostrils became clearer, less obstructed, crusts disappeared and respiration was freer.—DE S. LIMA, L. and DE C. CERQUEIRA, G.: Trial of soluthiazamide in the treatment of leprosy. Tropical Diseases Bulletin 43: 226-227, March 1946.

DIET ABOARD AN AUXILIARY SHIP

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Good food and the Navy general mess are regularly becoming more synonymous. Continuous research and expert planning have utilized our country's abundant resources to greatest advantage, while constantly improved methods of distribution have insured adequate fresh as well as dry provisions for even the smallest ships. Since, however, it is the eating habits of the consumer crews which ultimately determine the effectiveness of any dietary program, a study was conducted aboard a fleet auxiliary vessel in an endeavor to ascertain the extent to which naval personnel avail themselves of these incomparable nutritive opportunities.

PROCEDURE

A period of 1 month was selected, 31 days of "normal steaming" and "at anchor" conditions, immediately following departure from a combat area. The climate was persistently hot and humid after a few days' transition from a more temperate environment. Except for beer parties to nearby restricted beaches there was no liberty, and all foods were obtained from the ship.

Fourteen volunteers kept daily records of everything ingested except water. A representative group was obtained by utilizing six men from the medical department, four from the deck force, three from the engineer division, and one storekeeper. Two chief petty officers were included in an endeavor to demonstrate any differences between the general mess as served to them and as served to the remainder of the crew.

Diets were studied as follows: All items ingested during each 24-hour period were listed appropriately under breakfast, dinner, supper, or "supplementary" foods, these last including everything taken at other than regular meal times, from candy, peanuts, etc., to sandwiches for night watch-standers (a negligible factor in this survey). Amounts consumed were estimated in terms of familiar standards, household utensils principally. Measurements of galley and serving gear, of average mess-line portions, and of individual components of standard Navy recipes enhanced the accuracy of these figures. Each listed item was then evaluated for its approximate content of

protein, fat, carbohydrate, available calories, calcium, phosphorus, iron, vitamin A, thiamine, ascorbic acid, vitamin D, riboflavin, nicotinic acid, excess acid or alkaline ash, and fibrous residue, according to the figures of Bowes and Church.¹ Similar appraisals were made of the diet "as offered" in the general mess—the arbitrary ideal, based on average servings and not including overlarge and second portions frequently available. Finally, the computed data were used to determine the individual and average food intakes, and to compare these with statistics for the general mess, with calculated dietary needs and with figures generally accepted as standard requirements.

RESULTS

One man discontinued food estimates after only 6 days. All others persisted throughout the month, although 7 omitted at least 1 day's estimates, with a maximum of 8. Daily averages were recorded, and it was noted that 4 men whose intakes were self-estimated as below their usual amounts lost weight during the test period. (Two of these increased their intakes and began to gain shortly afterward.) No appreciable weight changes were noted by the other 10 subjects.

Average intake figures fell considerably below the standard galley-sample values. Calorie consumption was about 900 below the daily galley-standard content and 200 less than the calculated optimum. In no one instance did the individual intake, except for uncommon single meals, even closely approximate the amounts offered in the general mess, although one or more components of the diet were occasionally in excess of those figures. In only 4 cases, moreover, did the calorie consumption virtually equal or exceed the individual's calculated needs.

As intended, midday meals provided the largest proportions of calories (34.6 percent average), although evening meals contributed just slightly less (33 percent). "Supplementary" foods comprised an average of 12 percent of the day's total caloric intake, with figures ranging from 6.5 to 21.6 percent being recorded.

Deck-force personnel, as calculated, averaged the highest daily caloric intake, 2,815, to 2,454 for the hospital corpsmen, and only 2,201 for the men in the engineer division (far below their estimated average requirement of 2,817).

Two members of the chief petty officers' mess ingested an average of 2,794 calories per day (about 100 above calculated needs), while 12 men eating in the general mess line averaged 2,469 (approximately 300 below the calculated figure). Supplementary food items repre-

¹ BOWES, A. De P. and CHURCH, C. F.: *Food Values of Portions Commonly Used*. 4th edition. College Offset Press, Philadelphia, 1942.

sented 20 percent of the former but only 10 percent of the latter total.

In general, the consumption of protein, mineral, and vitamin components of the diet varied directly with the caloric intake, although greater proportions of these essentials were taken in the chief petty officers' mess.

COMMENT

The diet provided by the general mess aboard this vessel appears adequate in virtually every essential respect, falling below the optimum recommendations of the National Research Council only in riboflavin content.

The diet consumed by the average member of the crew is, in general, maintained at a considerably lower, if not exactly minimum accepted, level. The reason for this is not readily apparent, since, of the 10 men whose caloric intakes failed to reach calculated requirements, only the 4 who lost weight conceded any reduction in food consumption. Prevailing tropical conditions, with their recognized enervating effect, may account for the other suboptimal intakes, as suggested by the especially low figures for the heat-exposed engineer division, and because unequivocal satisfaction with the planning and serving of the meals seems to preclude any galley responsibility. Although a "reaction phase," immediately following a period of combat conditions may have been experienced, there was no evident trend toward an increased intake during the period of study.

The singular parallels between total caloric intake and protein, mineral, and vitamin consumption, while tending to substantiate other observations and even axioms, may partly reflect the inevitable condition when an individual choice of foods is virtually impossible. In the chief petty officers' mess, with its somewhat broader element of dietary prerogative—especially in the form of supplementary "snacks"—there was a significantly greater increase in the protein, mineral, and vitamin components than in the estimate exceeding caloric content.

The excess provided by the general mess menu over recommended dietary requirements is not as great with respect to minerals and vitamins (except vitamin A) as to calories and proteins. The average daily figures of 3,428 and 114 grams (63 percent animal protein) represent considerable margins over most caloric and protein needs, and the understandable failure of the men to consume such an overabundance has served to keep their intakes of "essentials" other than proteins below the optimum, but still probably above minimum, requirements.

Of all, calcium and riboflavin are the items seemingly sustained at the most critical levels, a condition usually prevailing under circumstances providing ample quantities of almost everything but milk.

Powdered milk, served daily at breakfast, with and without cereal, theoretically contributes a considerable proportion of these substances, but, since most men refuse it, other sources such as cream soups, creamed vegetables, puddings, ice cream and cheese dishes should be emphasized in order to compensate for at least a potential deficiency.

It must be stressed, too, that the data assembled represent ideals—quantities in foodstuffs unaltered by circumstances of preparation and serving. Although prolonged cooking, exposure to air and the discarding of valuable parts of vegetables and cooking water are reduced to a minimum, considerable losses, particularly of vitamins B and C, are inevitable. All estimates of essential diet elements, therefore, must necessarily be regarded as maximal rather than minimal available quantities, and the possible need for additional sources of minerals and vitamins should be borne in mind.

SUMMARY AND CONCLUSIONS

The general mess diet aboard this auxiliary vessel is, as offered, adequate in all essential respects.

The average crew member, regardless of duties, usually consumes considerably less than the amounts of food offered and, all too often, less than his calculated requirements as well.

The enervating effect of a tropical environment, with its recognized reduction of at least basal metabolic needs, is thought partly responsible for the low levels recorded, but an inability to consume the excess of calories necessary to insure an optimum intake of essential food components is regarded as another important factor.

When, as herein illustrated, the milk intake is at a minimum, other sources of calcium and riboflavin should be emphasized.

Mineral and vitamin losses during the preparation and serving of food are inevitable, and, where intakes approximate minimum daily requirements, supplementary sources of these essentials must be considered.

THE USEFULNESS OF THE CORNELL SELECTEE INDEX AT THE NEUROPSYCHIATRIC UNIT OF A NAVAL TRAINING CENTER

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and

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The first contact between the newly-inducted recruit and the medical department of a naval training center is the receiving line. Expeditious, and yet accurate, identification of the fitness of the newly inducted individual is attempted at this time. The psychiatric part of the medical examination of several hundred recruits in a single morning is, of necessity, brief. Time given individually to each man is apportioned in terms of minutes, sometimes seconds. It is obviously essential that there be a face-to-face interview between the recruit and the psychiatrist or psychologist. Although this clinical situation cannot be dispensed with, other devices may be used to supplement and speed it. One of the more obvious aids is a written questionnaire filled in by the recruit giving his estimate of various neuropsychiatric complaints. In the present article, the major issue under scrutiny is the value of one such questionnaire, the Cornell Selectee Index Form N, in identifying individuals unsuitable for the service who are not located by the usual clinical psychiatric interview.

This measure was prepared for use at the induction and reception of military personnel by various psychiatrists and psychologists from the staffs of New York Hospital, Cornell University Medical College, and Bellevue Hospital. The study which led to its development was aided by a grant from the Josiah Macy Jr. Foundation. They found that between 80 and 90 percent of those rejected or discharged at a variety of Army and Navy establishments were "screened" by this measure. In view of its purpose, its sponsorship, and the previous findings, it would appear that it deserves careful consideration as a device useful in identification of recruits showing neuropsychiatric complaints.

The Cornell Selectee Index is succinctly described by its authors ¹ as follows:

This sheet (Form N) is in essence a short neuropsychiatric and psychosomatic history consisting of 64 questions designed to uncover evidence of defects of a neuropsychiatric and psychosomatic nature. The questions are of two types: 10 items devoted to crucial symptomatology, for example "5. Have you ever gotten into serious trouble or lost your job because of drinking?" These are called "stop questions" because anyone exhibiting such symptoms should be "stopped" for neuropsychiatric appraisal. The remainder of the questions have less serious implications, such as, "29. Do you often have difficulty in falling asleep or staying asleep?" In this group a certain number of answers suggestive of difficulties in adjustment are the basis for referral for neuropsychiatric appraisal.

The "stop questions" are of great value in that they point out individuals who almost certainly have severe neuropsychiatric and psychosomatic problems while earmarking a minimal number of ostensibly healthy individuals. Thus, they are helpful guides to the neuropsychiatrist during his interview.

The Cornell Selectee Index—Form N is self-administered and can be given either to groups or to individuals; it requires about 5 minutes to complete and can be scored in less than 1 minute by persons with secondary-school education or its equivalent.

The procedure followed for the present study made no changes in the methods previously operative as the unit routine except that the Index was also used. During a certain period of weeks, all white recruits completed the Index on the day of their arrival at the training center prior to their appearance on the receiving line. No instruction was given other than to follow the directions on the form itself. Apparently the form was accepted as one more blank to be filled out. There was, however, no evidence that this attitude resulted in any considerable amount of carelessness.

The forms were scored by hospital corpsmen attached to the neuropsychiatric unit according to the key furnished by the constructors of the test. Toward the end of the physical examination, and roughly 100 minutes after they had entered the receiving line, they arrived at the private rooms occupied by representatives of the unit. Here the usual short, individual, clinical interview was given to the men. The nature of this interview varied in detail among the examiners. There was however unanimity of agreement in regard to certain focal points of investigation. All interviewers inquired about general health, nervousness, enuresis, somnambulism, and epilepsy. Headaches, head injuries, fainting spells, stomach disorders, and general aches and pains were investigated whenever there was the slightest indication that they might be relevant. General appearance, demeanor, gait, manner

¹ WEIDER, A., MITTELMAN, B., WECHSLER, D., WOLFF, H. G., et al.: The Cornell Selectee Index: Short form to be used at induction, at reception and during hospitalization. Cornell University Medical College, New York, N. Y. Mimeo., p. 6.

of expression, and the many almost un verbalized clues familiar to the clinician were also utilized in reaching a decision as to whether or not to go beyond the usual limited array of questions.

If, on the basis of this clinical session, the psychologist or psychiatrist thought the man exhibited signs of neurotic, psychotic, or neurological complaints sufficient to raise the question of his fitness, the procedure now to be described was followed. Without comment to the recruit, the relevant medical and psychological history as given by him was recorded. Then and only then, were the scores and answers of the Index examined. Critical scores followed a method suggested by the test constructors. Fifteen answers in the "unstable" direction or one or more "stop questions" resulted in the man being placed on trial duty irrespective of the clinical impression. In other words, the recruit was docketed for further study by the unit exactly as if clinical judgment had resulted in this decision being reached. The recruits selected for further study were placed on trial duty, which was a period of time, usually some weeks, during which the recruit was treated in no way differently from any other recruit. At the expiration of this period, a report from his company commander describing his behavior and making an estimate of his suitability for the service was obtained and the recruit brought to the unit for intensive clinical examination by the staff psychiatrists assisted by the psychologists. Many individuals were returned to full duty after this or later sessions and the record closed. If, at any time during the recruit's training the psychiatrist reached the decision that the man was unsuitable for the naval service, he would prepare a written report and present the man to the Aptitude Board for consideration for discharge. This board consists of five officers: The senior psychiatrist, a psychiatrist other than the one presenting the recruit for consideration, a medical officer other than a psychiatric specialist, a psychologist, and a line officer. After hearing the report and after group interview of the man, this board would recommend either that he be separated from the service with a discharge "under honorable conditions" or that he be returned to full duty.

For the purposes of this study discharge through recommendation of the Aptitude Board will be taken as the criterion of unsuitability for the naval service. The criterion of adequate adjustment in this study, on the other hand, is successful graduation from recruit training. This criterion is followed because when they graduate, recruits pass from the cognizance of the neuropsychiatric unit.

At this point it becomes possible to present the results in regard to the 212 recruits who were placed on trial duty. Forty-eight, or 22.6 percent, were placed on trial duty on the basis of clinical judgment alone, contraindicated by low questionnaire scores, 73, or 33.4 percent,

were placed on trial duty both on the basis of clinical judgment and of questionnaire scores, and 91, or 42.9 percent, were placed on trial duty on the basis of the questionnaire unsupported by clinical judgment. For convenience they will hereafter be referred to respectively as the "clinical," "both," and "questionnaire" groups.

There is an additional group to be considered, namely, those recruits referred to the neuropsychiatric unit by the regimental company commanders and dispensaries for consultation because of varied evidences of unsuitability. This group, not identified either from questionnaire results or from clinical impression, numbered 46.

TABLE 1.—*Number and percentage of recruits discharged in various groups*

Group	Number	Number discharged	Percent discharged
Questionnaire.....	91	8	8.8
Clinical.....	48	14	29.2
Both.....	73	30	41.1
Dispensary referral.....	46	31	67.4
Total.....	258	83	32.2

It will be remembered that the ultimate criterion is such observed unfitness to warrant discharge from the service on the recommendation of the Aptitude Board. Table 1 presents the data on discharge through this board for the various groups. It would appear from these data that the questionnaire, unsupported by previous clinical indications, offered little help in identification since only 8.8 percent of this group was ultimately discharged. Clinical judgment, although contradicted by the questionnaire, fared nearly four times as well, since 29.2 percent of this group placed on trial duty was discharged. Those identified first by clinical impression and then corroborated by the questionnaire resulted in discharge of 41.1 percent of the group placed on trial duty. It should be noted that this latter group was identified before consulting the questionnaire. For purposes of comparison of the discriminatory value of clinical impression and of the questionnaire it is legitimate to combine this latter group with that of the "clinical" group. Of the entire group of 83 discharged, "clinical" impression, either with or without questionnaire corroboration, contributed 44, or 53 percent, the "questionnaire" alone contributed but 8, or 9.6 percent. Examination of the questionnaires of the eight recruits that were successfully identified by it shows that only two completed it in such a fashion as to have no "stop" answers. It may be mentioned in passing that one of these two was also referred by a doctor in a dispensary since he was in ignorance of the fact that the recruit had been placed on trial duty. In other words, one man out of the eighty-three recom-

mended for discharge by the Aptitude Board would have been missed if no attention had been paid to the total score of the Cornell Index.

It is somewhat disconcerting to find 37.3 percent of the individuals discharged through the Aptitude Board were not identified on the receiving line either by clinical or questionnaire inspection with a consequent loss of time in ultimate disposition. An examination of the case histories of these recruits revealed that 17 of the 31, or 54.8 percent, showed the presence of enuresis, somnambulism, epilepsy, or the sequellae of severe head injuries. Evidently negative malingering was present since either or both the clinical interview and the Index contained specific pertinent questions which, if answered truthfully, would have resulted in the identification of all 17 of these as potential candidates for discharge. To what extent the remaining 14 were also negative malingerers cannot be judged, but probably even among these there were some that failed to answer truthfully, and therefore were not detected on the receiving line. In addition, an unknown number presumably hid their difficulties so successfully as not to be detected in the regiments and were sent to sea duty, thereby reducing efficiency.

The validity of the Cornell Selectee Index in this particular situation may be further explored by study of the mean item scores of the various groups. The possibility must be investigated that a shift in cutting score might product different results. By a cutting score is meant the total score used to divide those placed on trial duty from those not so placed. Certain relevant data are presented in table 2 for two of the groups, those placed on trial duty because of their adverse scores (the "questionnaire" group), and the group in which clinical judgment and questionnaire scores both pointed to a necessity for further study of the recruit. The results for the two groups are presented in terms of the arithmetical mean total scores for those placed on trial duty because of the total number of items referred to in the table as "Item No.," those placed on trial duty because of adverse answers to "stop" questions referred to in the table as "Stop Q.," and those showing both adverse total scores and the presence of "stop" answers referred to in the table as "Both No. & Stop Q." They are further subdivided into those returned to duty and those discharged.

TABLE 2.—*Mean item scores on the Cornell Selectee Index for certain groups*

Group	Item No.		"Stop" Q		Both No. and "Stop" Q	
	Duty	Aptitude board	Duty	Aptitude board	Duty	Aptitude board
Questionnaire	18.4	18.5	7.9	5.3	21.5	17.0
Both	20.1	20.7	10.2	8.6	25.5	23.4

The crucial comparisons are those between the means of those returned to duty and those discharged. All differences except two are such that higher mean scores are found in those returned to duty than in those who were discharged! The remaining two comparisons show differences of 0.1 and 0.6 percent which are obviously insignificant statistically. It would appear that no change in cutting score would improve the efficacy of the Index. This conclusion is reinforced by the lack of difference in item scores for the two other groups studied, the "clinical" and "referral" groups. The mean score for the "clinical" group returned to duty was 9.4 and the mean score for those discharged was 9.5. In the "referral" group the means were respectively 5.2 and 5.9. The arithmetical mean of "stop" answers was so close to 1.0 in all relevant instances that no figures are presented.

In summary then, it would appear that the total score of the Cornell Selectee Index contributes almost nothing to identification of men discharged at a naval training center for neuropsychiatric reasons and that the "stop" questions contained in the questionnaire, although somewhat more valuable, resulted in a very small additional identification. Presumably, more discriminatory and more economical methods could be devised for use in the particular situation described.

Whatever contribution the Index does make is by means of the "stop" questions. In addition, the data in regard to the group referred from the dispensary seem to show that the recruit must be impressed with the necessity of strict truthfulness in answering questions of a neuropsychiatric nature. In connection with this it has been observed that some recruits have protested that they gave honest answers when, for example, they denied they are sleep-walkers because they walk in their sleep only once a month. This suggests the advisability of questions framed to allow gradations of frequency rather than forcing them to choose only from a yes-no dichotomy, as does the Index.

The value of "stop" questions, the necessity for greater honesty, and the need to avoid dichotomy of two possible answers lead to the decision that it would be advisable to use, instead of the Cornell Selectee Index, a list of "stop" items drawn from this and other sources and framed to allow gradations of severity with a reminder in the body of the instructions of the possibility of disciplinary action if false statements are given. In a later article details of this technique and the results obtained will be described.

INTESTINAL PARASITISM

A Statistical Study on 1,000 Patients Recently Returned From Pacific Area Duty¹

PAUL MICHAEL
Captain (MC) U. S. N. R.

The possibility of dissemination of tropical and exotic diseases to the general population of this country by men returning from duty in tropical and subtropical areas of the Pacific has been mentioned in both military and civilian publications. Moreover, the civilian population has been alerted to this possibility, and every effort should be made to study all available data gathered on the subject to date. In most instances it may be safely stated that the possibility of spread is remote. In the majority of parasitic diseases from these areas, the intermediate host or vector either does not exist in this country or is present in insufficient numbers to constitute a definite hazard. In infections where no intermediate host is required, however, as in most intestinal parasitic diseases, a scrutinizing and critical attitude should be adopted so that this subject may be correctly evaluated. It was with this end in view that the following survey was instituted.

A study was made on 1,000 men who had recently returned from duty in the Pacific Ocean area, regardless of the entry diagnosis of the patient. A schedule was devised so that all patients were routinely studied, irrespective of clinical symptoms pointing to the gastro-intestinal system. The *Rhizopoda* were diagnosed through routine iron hematoxylin stains, utilizing the modified short technique as adopted by the U. S. Naval Medical School, National Naval Medical Center, Bethesda, Maryland. Concentration for helminths utilized the sucrose solution in preference as it afforded a longer period of elevation of ova in comparison to other methods.

DIAGNOSIS

Three thousand examinations were made on 1,000 patients with an average of 3 specimens per man. Intestinal parasites were found in

¹ This study does not presume to include an investigation of schistosomiasis. The ether-acid concentration method has been available for investigation but was not used routinely, and no patients presented themselves with symptoms which apparently warranted search for this parasite.

289 different individuals studied (28.9 percent), having 443 different protozoa or helminths, of which approximately 50 percent were pathogens. The type, number, and percentage of the various parasites encountered are shown in table 1.

TABLE 1.—*Intestinal parasites found in 1,000 service patients*

Type	Number	Percentage	Type	Number	Percentage
Endamoeba histolytica	89	8.9	Iodamoeba bütschlii	15	1.5
Giardia lamblia	45	4.5	(williamsi)	7	.7
Hookworm	38	3.8	Trichuris trichiura	3	.3
Endamoeba coli	69	6.9	Strongyloides stercoralis	1	.1
Endolimax nana	176	17.6	Ascaris lumbricoides	1	.1

Figures 1, 2, 3, 4, and 5 give in graph form the percentages and numbers of parasites in relation to the number of specimens examined. It is rather interesting to note that the diagnostic accuracy ran in parallel percentages for both the pathogenic and nonpathogenic forms. In most instances approximately 60 percent of the positive results were obtained on the first examination, and 90 percent were positive on completion of the third specimen. It is of further interest to note that the curve and percentage of the nonpathogenic *E. nana* and *E. histolytica* were almost identical, with the total number of *E. nana* approximately double that of *E. histolytica*. The high percentage of association of the two is considered some indication of the fact that when *E. nana* was found, there was a 44.3 percent chance that *E. histolytica* would also be demonstrated.

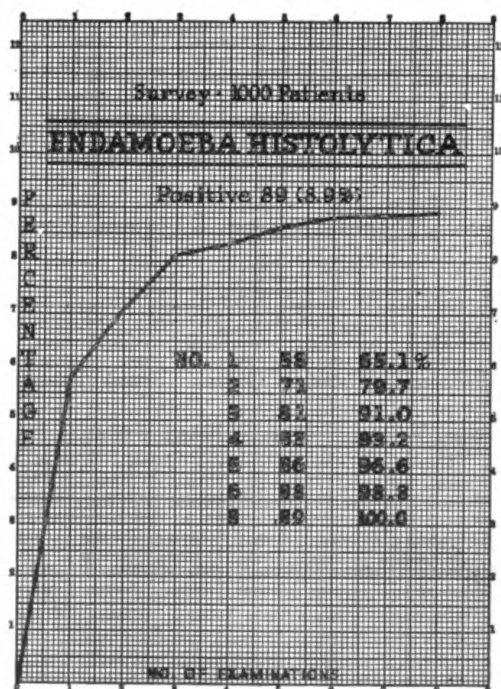


FIGURE 1.

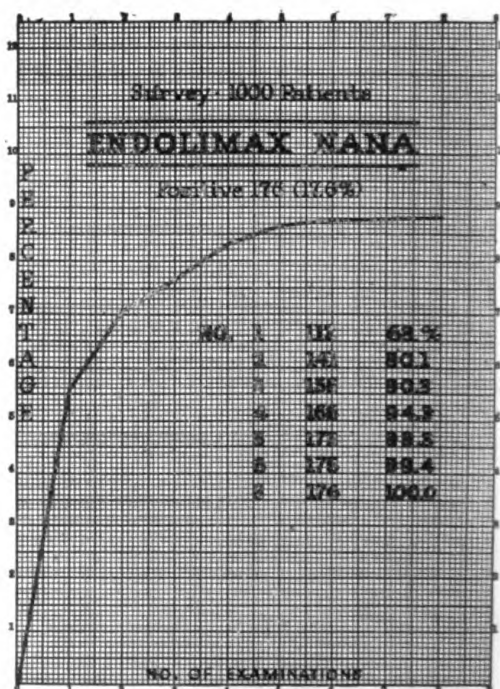


FIGURE 2.

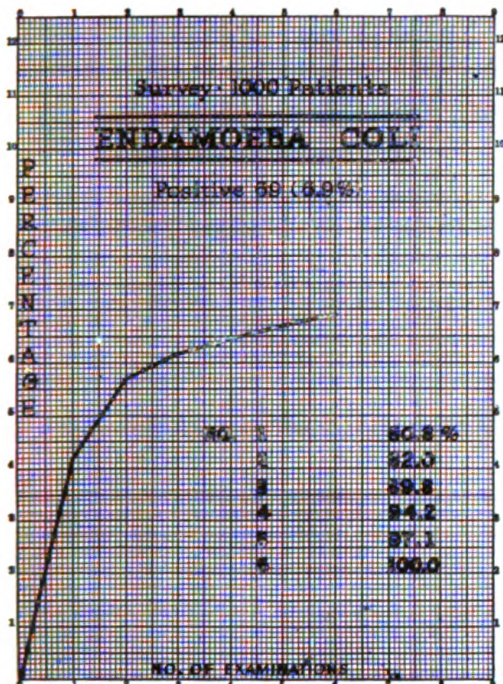


FIGURE 3.

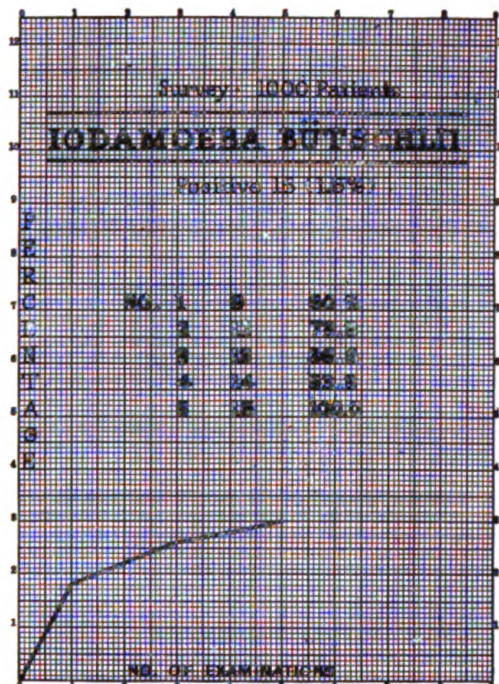


FIGURE 4.

Some attempt was made to study *E. histolytica* infections in more detail. Special forms were devised and made out on all these patients and the accumulated data summarized. Of the 89 patients having this parasite, 55 were among naval personnel and 34 were Marines. From the geographical point of view these men were investigated as to their place of duty and also their home state. Fifty-three had returned from duty in the Central Pacific or West Central Pacific areas. Of these 10 were from the Philippines, 19 were from Iwo Jima, and 8 from Okinawa. Fourteen had served in the South Pacific, 4 in the Central and Southwest, and 8 had been in all three areas recently. Ten of the men had been stationed aboard ships, while the remaining were billeted ashore. In reviewing the home states of the individuals, it was

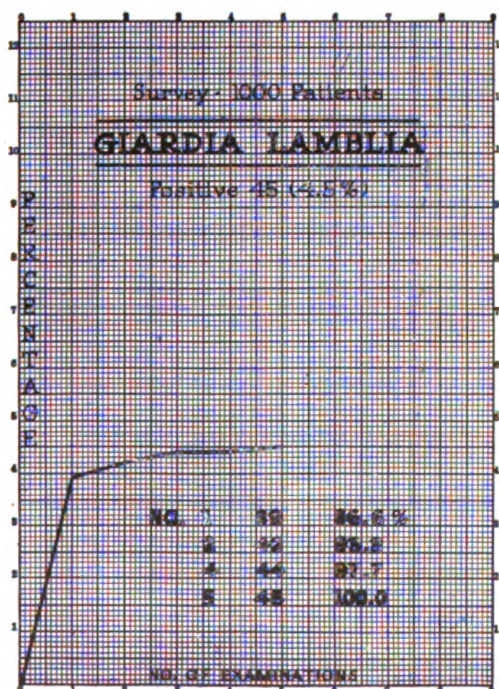


FIGURE 5.

found that only 22 had come from the Southern states where amebiasis is known to be statistically high. Sixty of the patients came from the Eastern seaboard, Central, Middle Western or Rocky Mountain states. In most instances, therefore, it may be assumed that infection occurred while the individual was serving overseas.

Clinical.—Five patients entered this hospital with the diagnosis of amebiasis already established, while the remaining 84 were diagnosed through the routine study of stools at this activity. Apart from these 5, it was found that only 10 patients were admitted giving histories of symptoms referred to the gastro-intestinal tract, and included such diagnosis as duodenal ulcer, colitis, pylorospasm, and gastritis. The remaining 74 patients were symptom-free so far as their gastro-intestinal systems were concerned. Of this number, 15 were admitted to the neuro-psychiatric service and 9 were diagnosed as arthritis, mostly of the lumbar spine. Most of these were seen to be either on a congenital basis or had a definite history of injury. None could be classed as infectious or directly associated with amebic infection. Fifteen had combat-gunshot wounds, 12 had skin infections, and 5 were suffering primarily from tertian malaria. In other words, it is obvious that if one depends upon gastro-intestinal symptoms alone to determine the probability of pathogenic amebae a large percentage of patients will be overlooked.

Pathogenicity.—*E. histolytica* alone was found in 34 individuals, or 38.2 percent. In 55 patients (61.8 percent) *E. histolytica* was associated with some other parasite. Of this number *E. histolytica* and *E. nana* were found together in 44.3 percent; *E. histolytica* and *E. coli* were in combination in 22.7 percent; and *E. histolytica* and hookworm in 9.09 percent. A further break-down revealed the fact that there was a comparatively large percent of small-race forms. Of the 89 patients, 29, or 32.6 percent, had small-race *E. histolytica*, 54, or 60.7 percent large-race, and 6, or 6.74 percent, had a combination of both. It was of further interest to note that the majority of these (24) had come from Iwo Jima or Okinawa. It was hoped that this series would afford an excellent opportunity to study and compare the clinical findings as observed in the two strains. Such an opportunity was denied, however, as it was observed that none of the patients harboring small-race *E. histolytica* presented any symptoms referred to the gastro-intestinal tract. This point brought to mind controversial opinions regarding the pathogenicity of this strain. Is the small-race *E. histolytica* truly a pathogen, or is it simply a small ameba having no more than four nuclei with other morphological characteristics of the large, well-established pathogen? E. Brumpt (1) in "Précis de Parasitologie" cites the work

done in 1918 by Sohei Shimura in Formosa. He claims to have identified a small ameba identical to *E. histolytica* (large-race) which was nonpathogenic to cats and named it *E. dispar*. Craig and Faust (2) question the authenticity of this and believe them to be variants of *E. histolytica*. Frey and Meleney (3), moreover, are of the belief that small-race *E. histolytica* is simply a variant and is definitely pathogenic. They were able to demonstrate a difference in virulence in the strains, but were unable to find any form eventually incapable of producing ulcerative lesions in the intestine of animals. The thought occurred to us, however, that the relative frequency of this small-race from a certain limited area formerly occupied by the Japanese was more than mere coincidence. In 1909 Koidzumi (4) described a small-race ameba in Japan which he called *E. nipponica*. It was seen sometimes in combination with large-race *E. histolytica* in patients suffering from dysentery and also not infrequently alone. He noted that this form frequently was observed ingesting red blood cells, and he concluded that it was a definite pathogen and capable of causing ulcerative lesions of the intestine. It is entirely possible that the small-race *E. histolytica* from Iwo Jima and Okinawa seen by us and the *E. nipponica* described by Koidzumi may be one and the same organism, both of which are mere variants of *E. histolytica*.

Blood studies.—Routine hematologic studies were conducted on all patients harboring this infection and no findings of note were encountered. Hemoglobin determinations below 65 percent and erythrocyte counts below 4,000,000 were considered the arbitrary dividing line. Nine percent of patients had a secondary anemia based on this figure. The average hemoglobin estimation on all patients was 84 percent (12.4 gm.) Haden-Hausser. Leukocyte counts were not of any diagnostic aid, and eosinophilia was indeed unusual. Two patients had an eosinophile count of 4.0 percent, one of 14.0 percent, and another of 12.0 percent. This latter patient also had a severe fungous infection of the skin and the increase may well be presumed to be due to this condition. All other instances where eosinophilia was obvious were seen in association with hookworm infection, and this was the only other parasite aside from *strongyloides* where an eosinophile increase was of any diagnostic importance.

Therapy.—It is not the purpose of this paper to dwell at length on the treatment of this condition, as this feature and the proctoscopic findings will be discussed in a subsequent communication. It was our policy so far as possible to treat all patients in whom *E. histolytica* was found. On the symptom-free carrier, diodoquin was the drug of choice, usually in combination with carbarsone. Fourteen patients in whom trophozoites or precystic forms were found were also treated

with emetine, and the dosage in all instances was in accord with present-day therapy. So far as was possible, no patient was permitted to return to duty, be transferred, or be separated from the naval service until adequate therapy had been given and a negative stool report obtained on three separate occasions. Any associated hookworm infection, giardiasis, or strongyloidiasis received indicated treatment in addition and the stools were properly checked. If patients were transferred to another naval activity before treatment was started or completed, notation was made in the health record to that effect.

DISCUSSION

It can be seen from the figures given that the percentage of amebic infections observed in men returned from tropical or subtropical areas falls within the normal incidence found in the general population of this country. In a composite survey accumulated by different writers in the United States, 9.8 percent of 60,491 individuals harbored this parasite. Individual series vary from very low figures up to 38.0 percent positive results in rural areas of Tennessee. Craig showed in 1926 that the average incidence of infection here was 10.0 percent. Boeck (5) and associates arrived at a figure of 4.0 percent, and this study endeavored to include a cross section of all areas, classes, and types of people. Our figures compare very favorably with those recorded by Markell (6). His survey included a study on 1,371 service personnel who had had duty in the South Pacific. In this group 28.0 percent of the men showed some parasitic infection, with a percentage of 8.09 percent *E. histolytica*. We had an opportunity in 1943 (7) to make a study of men from the South Pacific area and found 5.7 percent *E. histolytica* in a routine survey of 1,000 patients. As a large percentage of these included casualties from injuries received aboard ship, it would be expected that the figure would be somewhat lower as the opportunities for developing this infection are less than in shore billets. Other parasites, however, were quite comparable.

Following the first World War, Kofoed (8) and associates showed that among U. S. troops stationed in this country 4.3 percent harbored *E. histolytica*, while those on foreign service had 12.8 percent infection, yet it cannot be said that there was an appreciable increase in the incidence following the return of troops to this country. From the accumulated data to date, therefore, it can be said with some justification that it is unlikely that intestinal parasites will be disseminated to the general populace in sufficient numbers to constitute a public health hazard. It is our opinion, however, that some attempt should be made to diagnose patients harboring this parasite, and

institute proper treatment before these men are separated from military or naval service.

SUMMARY

1. A survey is reported on 1,000 patients recently returned from duty in the Pacific Ocean area on whom routine stool examinations were made regardless of symptoms.

2. In this number, 289 patients (28.9 percent) presented evidence of intestinal parasites, 8.9 percent of whom showed an incidence of infection with *E. histolytica*.

3. It would appear from accumulated data to date that intestinal parasites are not being introduced in sufficient numbers to constitute a public health hazard.

4. Whenever practicable, the policy should be adopted to investigate all such personnel and institute proper therapy if indicated before separation from the military services.

NOTE

Since completing the foregoing survey on returned patients, the author has had the opportunity to make a study of intestinal parasites as seen in repatriated prisoners of war reaching this country. Because of the rapid processing of these persons, both civilian and military, an average of only one stool per individual was studied, therefore the percentage must be based on these data. It was also impossible to determine the geographical locality of each person returning to the mainland, as most of them had been in from two to six different camps and had been prisoners in various localities. For instance, those captured on Wake Island or Guam were for the most part moved directly to the main islands of Japan, whereas those captured in the Philippines or elsewhere were imprisoned in the Philippines first. From there, many of them went to Formosa and from there to Japan where several moves usually were made. A certain number of them had also been interned on the mainland of Asia. It is interesting to comment on the fact that even though the prisoners have been in localities where intestinal parasitism ranged from 80 to 90 percent in the general population, the individuals were still able to take sufficient precautions so that the incidence of infection was surprisingly low, especially in regard to hookworm infection.

An interesting observation was made in regard to infection of *Giardia lamblia*. It has been not infrequently noted that the low incidence of this parasite observed was due in part to the use of atabrine in large numbers of patients received from the Pacific area, yet the percentage of *Giardia lamblia* found in repatriated prisoners was only 3.8 percent. Very few of these individuals had received atabrine.

Table 2 shows the breakdown of parasites as observed in 1,000 repatriated prisoners of war.

TABLE 2.—*Intestinal parasites found in 1,000 repatriated prisoners of war*

Type	Number	Percentage	Type	Number	Percentage
<i>E. histolytica</i> (small).....	7	0.7	<i>T. trichiura</i>	137	13.7
<i>E. histolytica</i> (large).....	24	2.4	<i>G. lamblia</i>	38	3.8
<i>E. histolytica</i> (total).....	31	3.1	<i>E. coli</i>	29	2.9
Hookworm.....	159	15.9	<i>E. nana</i>	50	5.0
<i>A. lumbricoides</i>	142	14.2	<i>I. butschlii</i>	7	.7

NOTE.—450 persons (45 percent) had 624 parasites of which approximately 90 percent were pathogenic.

REFERENCES

1. BRUMPT, E.: Précis de parasitologie. 5th edition. Masson et Cie., Paris, 1936.
2. CRAIG, C. F. and FAUST, E. C.: Clinical Parasitology. 2nd edition. Lea & Febiger, Philadelphia, 1940. p. 51.
3. FREY, W. W. and MELENEY, H. E.: The pathogenicity of a strain of small race *Endamoeba histolytica*. Abs., J. Parasit. 23: 555, December 1937.
4. JOHNSTONE, H.: Personal communication.
5. BOECK, W. C. and STILES, C. W.: Studies on various intestinal parasites (especially amoebae) of man. U. S. Pub. Health Serv. Hyg. Lab. Bull. No. 133. U. S. Government Printing Office, Washington, D. C., 1923.
6. MARKELL, E. K.: Intestinal parasitic infections in a naval hospital in New Zealand. U. S. Nav. M. Bull. 44: 65-68, January 1945.
7. MICHAEL, P.: Hazards of tropical diseases. Bull. Am. Col. Surgeons 28: 154-156, June 1943.
8. CRAIG, C. F. and FAUST, E. C.: Clinical Parasitology. 2nd edition. Lea & Febiger, Philadelphia, 1940. p. 48.



THE INFLUENCE OF A PLACEBO, BODY POSITION AND MEDICATION ON MOTION SICKNESS

Authors' conclusions and summary.—1. The results of this study were obtained in some 60 experiments, involving more than 15,000 unselected young men.

2. There was no "placebo" effect. The incidence and the severity of sickness which developed in groups receiving a placebo and in untreated control groups were of the same order. This indicates that psychic factors are of minor importance in the causation of motion sickness as it occurs in a large unselected group of individuals.

3. In landing craft the position of the body and/or head is a potent factor in determining the incidence and severity of seasickness.

4. Hyoscine alone or combined with hyoscyamine, atropine, or certain barbiturates is a very effective medication for the prevention of seasickness.—TYLER, D. B.: The influence of a placebo, body position and medication on motion sickness. The American Journal of Physiology 146: 458-466, June 1946.

EDITORIALS

EXTRACTION OF CINCHONA ALKALOIDS IN THE FOREST

From the standpoint of the number of cases and the number of deaths annually as well as its economic effects, malaria is perhaps the most important of the diseases of man. Anything therefore pertaining to quinine, the great specific drug for malaria, is of unusual interest. Just before and during the war, the acid extraction of the cinchona alkaloids from the bark had been demonstrated. To this ion exchange adsorption system was added. During World War II the Research Group of the Engineer Board of the Army made a still further advance in the method of obtaining the alkaloids.

Field units of a portable type for carrying on the acid extraction and ion exchange adsorption were set up in the Cinchona Forest of South America and the fresh bark successfully processed to obtain over 80 percent of the cinchona alkaloids. Applezweig and Ronzone successfully used a portable quinine extraction plant consisting of maceration tanks, an ion exchange adsorption system, and a distilling unit in the field. This method of recovery of the cinchona alkaloids has many advantages. It is rapid and economical, permits the use of the green bark, and saves transportation of the dried bark. This new method of obtaining one of the world's most important drugs constitutes a most notable pharmaceutical and medical advance. Furthermore, the method of ion exchange adsorption has been tested in the extraction of other alkaloids, such as morphine, atropine, and cocaine, and found capable of adaption for that purpose. This new method of drug extraction therefore is capable of many other applications and its significance has not yet been fully appraised nor its possibilities exhausted.

1597



THE IMPORTANCE AND GEOGRAPHICAL DISTRIBUTION OF MALARIA

Many epidemiologists have considered malaria the most important disease of man and it is estimated that there are probably about 3 million deaths a year from this disease.

The geographic distribution of malaria is very extensive. Roughly an area of about 30° of latitude on each side of the Equator may be considered as the real malarial belt which encircles the earth. However, it has been found as far north as 65° of latitude in Europe and Asia and about 40° north latitude in North America. Where malaria is absent it is due to the absence of the insect vector or a mean temperature not greater than 15° Centigrade or 59° Fahrenheit. All continents are affected.

Many of the Pacific islands are free from malaria, due to the absence of the insect carrier. Fiji, Hawaii, Tahiti, and Samoa are included among these areas.

It is estimated that there are approximately 10,000,000 cases in India and possibly nearly that many in Africa. Many medical historians have brought forward evidence to show the effect of this disease upon the history of mankind. There are strong indications that the collapse of the Roman Empire was due in part to the effects of malarial infection. The decline of a number of the Greek City States has been attributed to it. It has not definitely been settled whether the disease was brought over from Africa in the slave ships, or whether it was found in the Americas at the time of the discovery and the conquest. Many believe it existed in Central and South America long before the Columbian discovery, and the Peruvians of the Incan period were acquainted with it and used cinchona in the treatment.

The fact that malariology has become an important subspecialty of tropical medicine and epidemiology is an indication of the leading position which this disease holds among the many diseases of man.



NEW TYPE OF DENTAL DRILL

The Journal of the American Dental Association contains notice of the development of a new type of dental drill. It is expected it will replace the present grinding drill and is one which operates somewhat on the principle of the sand-blast. Dr. Robert B. Black of Corpus Christi, Texas, who devised the drill describes it as "airbrasive." In other words, an abrasive material is driven by a fine stream of com-

pressed air. Aluminum oxide is the abrasive used. The advantages over the ordinary rotary drill are:

- (a) Precise control;
- (b) Faster cutting;
- (c) Elimination of vibration, heat, and the unpleasantness of the grinding sound; and
- (d) Reduction in the amount of pain.

The used abrasive material and the removed portion of the tooth are thrown into a vacuum hood on the instrument.

This instrument is something new and has as yet been used only to a limited extent. It is, however, a very promising development.



ANIMAL DISEASES AND MAN

The number of animal species alive on the earth has been estimated to be approximately 1,000,000. Dr. Ernst Mayr, Curator of the Whitney-Rothschild Collections in the American Museum of Natural History of New York has some interesting estimates of the various classes of animals. He believes there are about 3,500 species of mammals and that there are 8,616 species of birds known in the world today. He thinks there are not more than 100 species of birds not yet discovered.

These warm-blooded animals have diseases which in some cases may be transmitted to man, and are consequently of great importance in preventive medicine. What is of almost equal importance, however, is the fact that many animals become immunized to agents not pathogenic to man in which the antibodies are curative of diseases of man.

Recently it has been demonstrated that the tubercle bacillus peculiar to voles may be used to vaccinate guinea pigs which are then found to be protected against mammalian tuberculosis. This of course suggests the vaccination of man with this vole-type bacillus in order to protect him against ordinary tuberculosis.

This example shows the great possibilities in disease prevention from the study of the diseases and immunization of animals from the viewpoint of immunity developments of value in preventing human diseases due to similar strains of causative organisms.

CLINICAL NOTES

SPONTANEOUS PNEUMOTHORAX

REPORT OF A CASE

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and

ALVA C. SURBER, JR.

Commander (MC) U. S. N. R.

Certainly there is nothing very original or startling, except to the patient, about a spontaneous pneumothorax. The literature on the subject is vast. However, the unique way in which this case developed, and the conditions under which it was observed and treated, make it both interesting and worthwhile for medical officers serving afloat. The case developed aboard a heavy cruiser which at the time was engaged in a very active and difficult operation in the Pacific. Of chief interest was the x-ray study. The only x-ray facility aboard was a General Electric dental unit. This unit was a constant source of amazement. We had had no idea that a small dental unit could be as useful as it turned out to be. With it we located explosive fragments in all parts of the body, diagnosed fractured skulls, visualized urinary calculi, visualized abnormal kidneys by means of diodrast, and located fractures of nearly every bone in the body. Perhaps its greatest service was in the diagnosis of pulmonary diseases.

The technique of taking a chest plate was relatively simple. The machine was firmly attached to the bulkhead in such a position that it could be swung to the dental chair. When employed for chest work it was swung as far out into the dental office as possible and brought down to the level of the chest to be x-rayed. The patient was seated upright with his back to the machine on a high surgical stool 72 inches from the x-ray tube, and the cassette held in front of the patient by a hospital corpsman. Since the dental unit was fixed at 10 milliamperes and 85 kilovolts, the timer was the only variable. The time employed on the average chest was 1 second, which gave an exposure of 10 miliampere seconds at 85 kilovolts and at a distance of 72 inches.

The hospital corpsman who stood in front of the patient and held the cassette was naturally in a vulnerable position. However, the average small volume of such x-ray work, plus the fact that a different hospital corpsman was employed each time, precluded any significant danger to personnel.

CASE REPORT

The patient was a 27-year-old white, American, gunner's mate, first class, who came to sick call 4 June 1945 complaining of a pain in the left side of his chest of 4 hours' duration.

Family history.—Negative.

Past History.—The only time he could remember having been sick was 12 years previously when he had mumps. He had been aboard the ship for 5 years during which time he had not had a single day on the sick list.

Present Illness.—He awoke at reveille at 0400 and went to the toilet to have a bowel movement. While sitting and smoking he was seized with a paroxysm of coughing and suddenly experienced an excruciating pain in the left side of his chest. He did not lose consciousness and was able to make his way to his 40 mm. gun battle station when general quarters sounded at 0420. In order to reach his station he had to climb up ladders to two decks above the one on which the toilet was situated. This climbing made him very short of breath, but he made it and assumed his duties as gun captain. The pain subsided somewhat and as long as he remained quiet he was not short of breath. At 0800 he came to sick call.

Physical Examination.—Temperature, oral; 98° F.; pulse 70; respiration 18; blood pressure 110/70.

The patient was a thin, wiry man in no apparent great distress, but with an apprehensive look. Except for the neck and chest his physical examination was negative. On palpating his trachea it was found to be deviated to the right. The left side of the chest was apparently larger than the right and moved less on respiration. The heart had shifted somewhat to the right as the apex sounds were heard loudest at the left sternal border in the fifth intercostal space, but also could be heard distinctly at the right sternal border. Otherwise the heart was normal. Examination of the lungs showed all the classical signs of a left-sided pneumothorax: Absent vocal fremitus, hyperresonance, absent breath sounds, and greatly diminished voice sounds.

X-ray report (see fig. 1).—Pneumothorax on the left side with a total collapse of lung. Both lobes appear as small nubbins peering out from the left cardiac border. The heart is displaced to the right. The right side of the chest is normal.

Treatment.—To bed for rest and observation.

Course.—From 5 June 1945 to 11 June 1945 the patient was kept in bed. On the second day he developed a slight rise in temperature and examination showed that he had a common

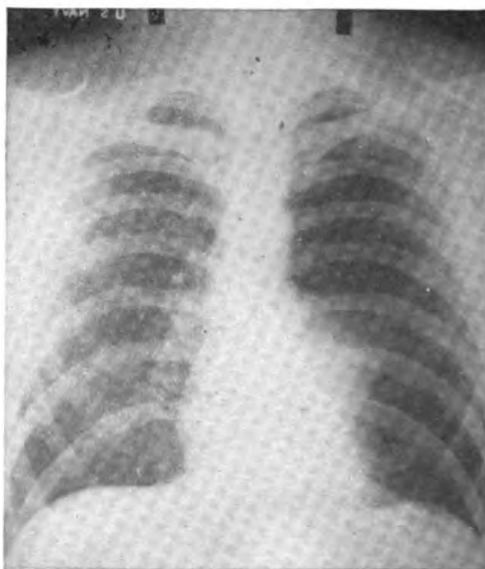


FIGURE 1.

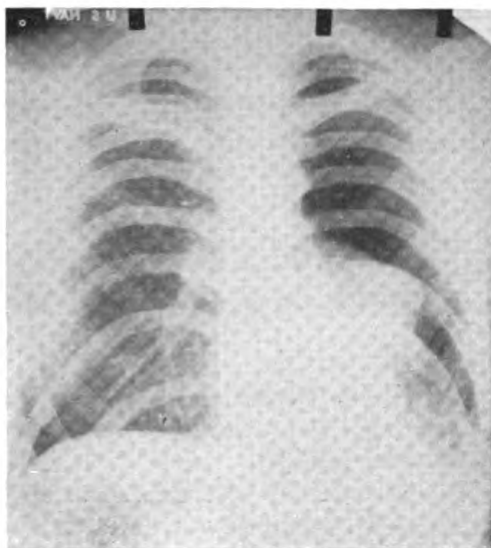


FIGURE 2.

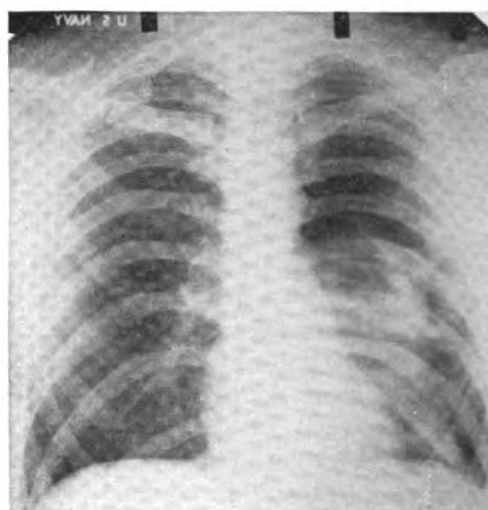


FIGURE 3.

cold with nasal discharge, slight sore throat, and cough. He was placed on sulfathiazole, largely as a preventive measure, and on the following day his temperature was normal. Sulfathiazole was continued for 6 days and then stopped. During this week the chest pain largely disappeared and the patient was comfortable as long as he remained quiet. At the end of the week physical examination still showed all the signs of a left-sided pneumothorax.

On 11 June 1945, 600 cc. of air were withdrawn from the left pleural cavity and an immediate chest plate taken (fig. 2). The x-ray picture showed the heart to have shifted toward the left, the left diaphragm to be elevated, and the left lung to have filled out a little. The patient was given a narrow-necked bottle with instructions to blow into it for 10 minutes three times a day.

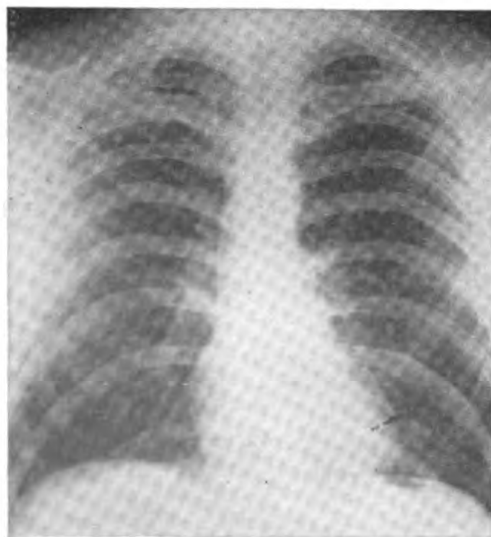


FIGURE 4.

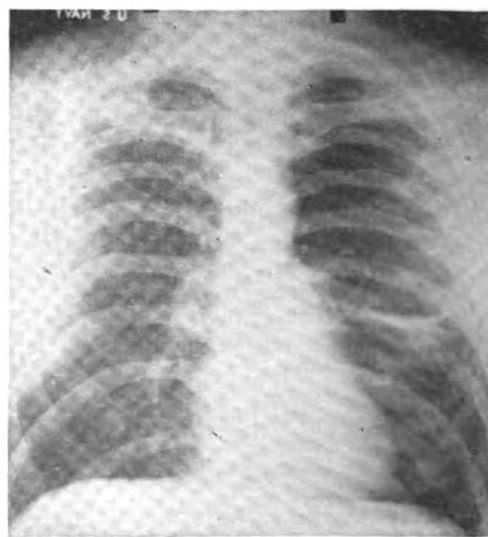


FIGURE 5.

A chest plate taken 13 June 1945 showed a definite increase in aeration of the left lung and the heart in its normal position (fig. 3). The patient was allowed up during the daytime and permitted to wander around the ship.

A chest plate taken 14 June 1945 showed the left lower lobe to be fully aerated, but the upper lobe still partially collapsed (fig. 4).

On 17 June 1945 a chest plate showed an increase in aeration of the left upper lobe (fig. 5).

The 19 June 1945 chest plate revealed the almost complete return to normal of the entire left lung (fig. 6). The patient was sent to light duty, after having been on the sick list 15 days.

On 26 June 1945 the patient was called in for a check-up. He felt well and had no symptoms. Physical examination was entirely normal. The chest plate (fig. 7) showed a normal chest.

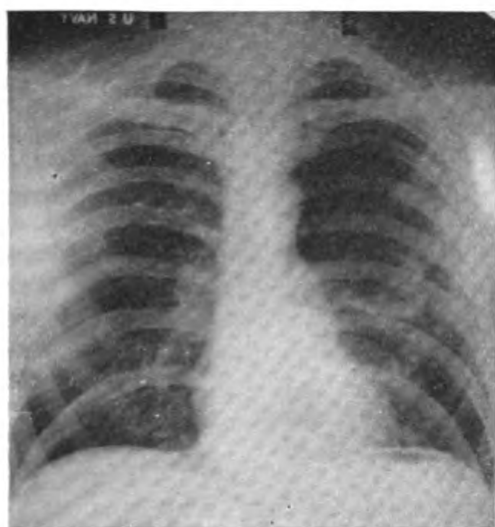


FIGURE 6.

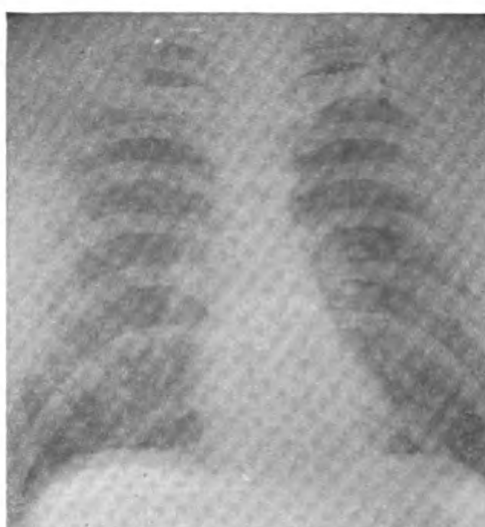


FIGURE 7.

COMMENT

This case has been reported not because of its medical rarity, but simply to show what can be done with limited facilities in a forward area where hospital ships were not as yet available. The medical officer afloat is too often prone to transfer patients to hospitals. Forward-area hospitals and hospital ships are full of high-priority combat casualties, and such patients as the one reported would only further aggravate a congested situation. It is hoped that the described technique of using the dental x-ray unit for chest work will prove helpful to other medical officers afloat.

ACKNOWLEDGMENT.—The authors wish to acknowledge the work done by Burns, C. B., Ph.M.2c, x-ray technician; and Baker, L. B., S.1c, acting ship's photographer in making the x-ray photographs.

SECONDARY INFECTION OF DERMATOPHYTOSIS

REPORT OF A CASE

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The following case is reported to call attention to the fact that not infrequently chronic fungous infections become secondarily infected with organisms causing pyogenic lesions.

CASE REPORT

The patient was a 22-year-old white male who enlisted on 14 October 1942 and received recruit training at Great Lakes. After his recruit training he was transferred to the Gunner's Mates School at the Naval Training Center, Gulfport, Miss., and later assigned to sea duty. While aboard ship he was wounded by shrapnel in the right leg on 11 July 1943. He was held aboard ship for 1 month and then transferred to a dispensary ashore at Oran, North Africa, where he remained for 12 weeks. He returned from sea duty to Bremerton, Wash., and from there was transferred to the Naval Training and Distribution Center, Farragut, Idaho, on 23 March 1945.

A few days after reporting to the dispensary at Oran, North Africa, vesicles appeared on the wrists, on the dorsal surfaces of the hands, and on the sides of the feet. These lesions ruptured within 48 hours. Treatment consisted of boric-acid soaks and local application of zinc-oxide ointment. Progress was slow, but by the time the man was returned to the ship, the lesions were no longer visible.

In March 1944, while aboard ship, the vesicles reappeared on the dorsum of the right foot. The condition was diagnosed as ringworm and was treated as such. Although the right foot was the only extremity involved at that time, recovery was not complete until the end of May 1944.

On 27 January 1945, while confined in the brig at Bremerton, Washington, the lesions again appeared, this time on the dorsal surfaces of both feet. The formation of crusts was slow and not complete until the end of February 1945. Sulfadiazine was not administered either as a prophylactic or a curative measure during confinement at Bremerton. The day following arrival at the Naval Training and Distribution Center, Farragut, Idaho, this man was admitted to the sick bay for treatment of the foot infection. Therapy consisted of foot soaks. The lesions receded slowly, and the patient was discharged to duty on 28 April 1945.

On 30 April 1945 this man was included in a survey for hemolytic streptococcal infections being conducted on inmates of the brig. Positive cultures were obtained from this man's throat, mattress cover and blanket, all exhibiting beta hemolytic colonies.

On 1 May 1945, new vesicles were noticed on the hands and several days later on the feet. At this time the lesions, instead of containing a clear, watery exudate, were filled with a purulent exudate. Local treatment, consisting of boric-acid and potassium-permanganate soaks, was instituted, and crusts formed; improvement was gradual until 17 May 1945. Cultures taken then from the throat, lesions, bed sheets, mattress cover, and mattress were found to contain numerous colonies of beta hemolytic streptococci. Five doses of penicillin, each containing 20,000 Oxford units, were administered every 3 hours by the

intramuscular route. Marked improvement was noticed immediately following the institution of this therapy. On the fourth day, 22 May 1945, healing of the hands was complete and, with the exception of three deep-seated crusts, the feet were normal in appearance.

The results of the cultures taken were as shown in the following table:

Source	Organism found in cultures taken on dates shown	
	17 May 1945	30 Apr. 1945
Throat.....	Group A, type 17.....	Group C.
Bed sheets.....	do.....	
Blanket.....	do.....	Do.
Mattress cover.....	Group A, not a common type.....	Do.
Mattress.....	Group A, type 17.....	
Proximal end of finger.....	Group A, not a common type.....	
Hand.....	Group A, type 17.....	

DISCUSSION

This case is presented to emphasize the necessity for culturing all open lesions of apparent fungous origin which have had the opportunity to become infected secondarily with the hemolytic streptococcus.

Atypical lesions, in this case pustules rather than vesicles, indicated the presence of a new entity superimposed upon a chronic recurrent fungous infection.

To explain the source of the streptococcus responsible for the secondary infection the following possibilities are suggested: (a) Droplet infection from the throat of the patient (the patient's culture was known to contain numerous hemolytic streptococci); (b) droplet infection from the throat of another person in the same area (72.6 percent of the men in the Bremerton group were known carriers of the hemolytic streptococcus); (c) direct contact with bedding, which contained numerous hemolytic streptococci and belonged to either the patient or another person in the same area (41.9 percent of the blankets and 52.3 percent of the mattress covers used by the Bremerton group (117 men) contained hemolytic streptococci); and (d) air-borne infection from particles of lint and dust which contained hemolytic streptococci, which mode of infection would probably occur during bedmaking, sweeping, and periods of greatest activity of the room occupants.



SYPHILITIC REINFECTION AFTER TREATMENT WITH
PENICILLIN

REPORT OF A CASE

LIONEL C. RUBIN

Commander (MC) U. S. N. R.

The following case is probably an instance of reinfection in an early case of syphilis treated with penicillin.

Case report.—A 25-year-old, white, married, Marine Corps enlisted man was exposed extramaritally on 23 December 1944. On 7 February 1945 he reported to sick call with an eroded sore on the ventral surface of the shaft of the penis, about one-half inch from the glans, associated with several enlarged, nontender, discrete, right inguinal lymph nodes. The darkfield examination was positive for *Treponema pallidum* on 13 February 1945. The Kahn, Kline, and Wassermann blood tests were negative. His source of infection was reported by the State Health Department to be under treatment for primary syphilis. His wife, who was 2 months pregnant, was his only other contact. He had marital relations with her until the appearance of his chancre. She was examined on 20 February 1945 by her obstetrician, who found no clinical or serologic evidence of infection.

The patient was given a total of 2,400,000 units of penicillin, 40,000 every 3 hours, day and night, for 7½ days. No other antisyphilitic therapy was used. The sore healed rapidly. On 20 March and 20 April 1945 physical examination revealed no abnormal findings, and the Kahn tests were both negative.

On 17 May the patient reported again for his monthly checkup. He had resumed marital relations with his wife on 20 March. There were no new extra-marital contacts. On 20 April she noticed a painless sore on the vulva. On 10 May she became ill with headache, sore throat, and a rash on the palms and genitalia.

Our patient on examination, 17 May, had a large eroded, indurated sore on the right side of the penoscrotal fold. There were six smaller indurated papules, pinhead to pea size, in close proximity to the large sore, all on the right side of the scrotum covering an area the size of a silver dollar. The right inguinal lymph nodes were enlarged, non-tender, firm, and discrete. The site of the first chancre on the shaft of the penis was marked by a thin scar. No other lymph nodes were enlarged. He had no rash, mucous patches, or sore throat. Dark-field examination of the largest of the sores was positive for *T. pallidum*. The Kahn test on the blood was negative. A week later, 23 May, the Kahn was positive.

His wife was referred on 19 May to a medical officer of the United States Public Health Service who found a large chancre on the fourchette teeming with spirochaetes, generalized lymphadenopathy, and a papular secondary rash involving the palms, soles, and genitalia. Her serologic examination was strongly positive. She was 5½ months pregnant.

Our patient was retreated with 2,400,000 units of penicillin. Twenty-four hours after the beginning of his treatment the darkfield examination was negative. He was discharged in 8 days with the sores healed. His wife received 1,200,000 units of penicillin, 300 mg. mapharsen, and 600 mg. bismuth, between 19 and 28 May without any untoward reactions.

COMMENT AND SUMMARY

The sequence of events in this case was as follows: The patient acquired primary syphilis (seronegative) from a proved extra marital source. He infected his wife, who was in the incubation period on her first contact examination in March. She developed early syphilis during the time that he was under treatment; and when they resumed marital relations 1 month after he finished his course of therapy, she reinfected him.

The following additional data indicate the case is probably one of reinfection, rather than of relapse:

1. The unilateral scrotal lesions on a site different from that of the first chancre.
2. The presence of the unilateral satellite adenopathy.
3. The absence of other lesions.
4. The Kahn test, negative on first examination becoming positive on the second examination.
5. The more advanced stage of the infection in his wife.
6. The plausible incubation periods.

This case of reinfection is presented as evidence that 2,400,000 units of penicillin given intramuscularly over a period of 7½ days, without any other form of antisyphilitic therapy, will cure primary seronegative syphilis.



LOCALIZED AMYLOIDOSIS OF THE URINARY BLADDER

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and

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Although amyloid disease usually occurs as a systemic infiltration secondary to suppuration or multiple myeloma or as a primary affection of groups of organs, it may be encountered occasionally as a localized tumor. These so-called amyloid tumors are encountered in various organs. In the upper respiratory tract and in the urinary tract they are seen frequently enough to become problems in differential diagnosis.

The first amyloid tumors of the bladder were described in post-mortem reports (1) (2). Since 1932, when Chwalla (3) discovered

the third case on cystoscopic examination, three additional tumors have been reported (4) (5). These tumors caused hematuria, had the appearance of neoplasms, and were resected as neoplasms except in two cases when preoperative biopsy established the diagnosis. Bladder resection followed biopsy in one of these as the method of choice.

We are describing a patient with an amyloid tumor of the bladder discovered at cystoscopic examination and treated by partial resection of the bladder.

CASE REPORT

The patient, a seaman, second class, was admitted to the urological service on 11 June 1944 because of hematuria of 2 days' duration. He had no other complaints. He was a 34-year-old white male, 6 feet tall, weighing 240 pounds. The physical examination was negative. The blood Kahn was negative and the complete blood count normal. An uncentrifuged specimen of urine showed 12 red cells per high dry field. Cystoscopic examination on 13 June 1944 revealed a small sessile lesion on the anterior superior aspect of the bladder mucosa. This had a yellow edematous appearance and oozed blood. It was thought to be an infiltrating neoplasm, and because of its accessible location, a suprapubic excision of this portion of bladder wall was elected. On 16 June 1944 under spinal anaesthesia the lesion was excised with adjacent bladder wall. The bladder was closed around a de Pesser catheter drain. The postoperative course was uneventful and the patient was discharged on 8 July 1944 feeling well.

DESCRIPTION OF THE SPECIMEN

Gross examination.—The specimen consisted of a segment of bladder wall measuring 4 by 3 by 0.8 cm. In one portion of this the entire thickness of the bladder wall appeared to have been removed. This portion measured 2 by 1.5 by 0.8 cm. The remainder was composed of mucosa and superficial muscle fibers. The mucosa overlying the full thickness of the bladder wall was soft, red, and velvety. The remaining mucosa was covered with soft, yellowish-white plaques.

Microscopic examination.—Several sections through the mass had essentially the same appearance. Atrophic bladder mucosa was raised over lobulated masses of glistening amorphous pink-staining comparatively acellular material resembling amyloid. Foreign-body giant cells could be seen adjacent to some of the submucous masses (fig. 1). Red cells in the submucosa suggested hemorrhage from superficial vessels distorted by the infiltrations. A slight focal lymphocytic infiltration was also seen in the submucosa. Some of the small vessels had amyloid cuffs about them. Superficial bundles of smooth muscle were replaced partially or completely by the amorphous masses. Here and there interstitial infiltrations of eosinophiles were seen around the affected muscle bundles. Pyknotic muscle nuclei and disintegrating eosinophiles were seen in and about some of the muscle fibers showing the amyloid change (fig. 2). Larger cells resembling histiocytes were also present. At one point a focus of calcification was located in an amyloid mass. Frozen sections stained with Congo red gave a typical amyloid reaction, while those stained with crystal violet did not stain typically. The material stained red with sudan IV.

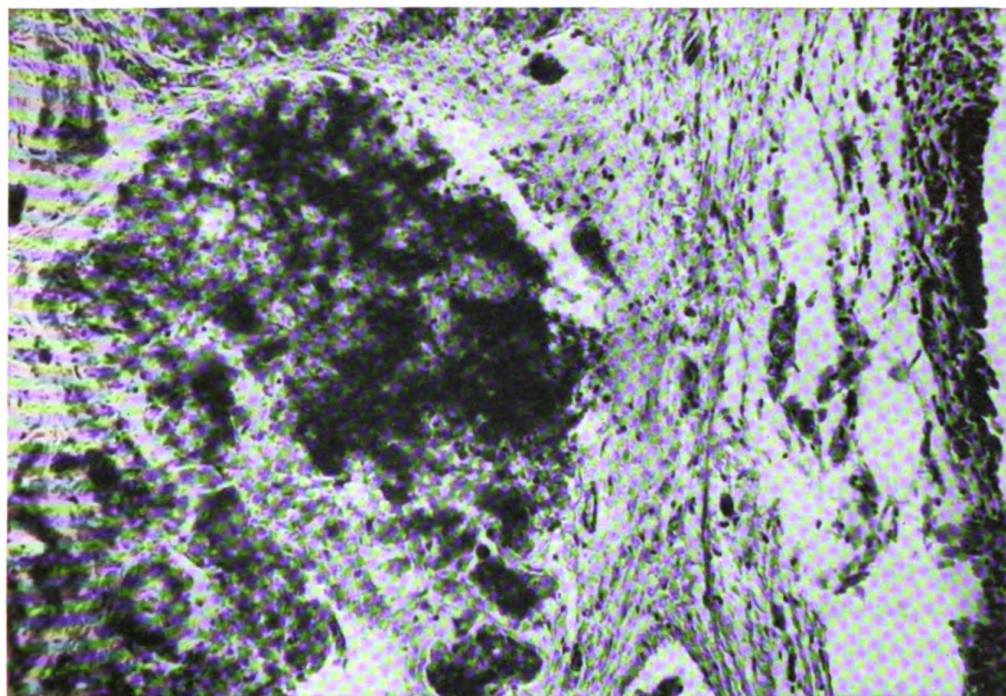


FIGURE 1.—Amyloidosis of the bladder-submucosa.

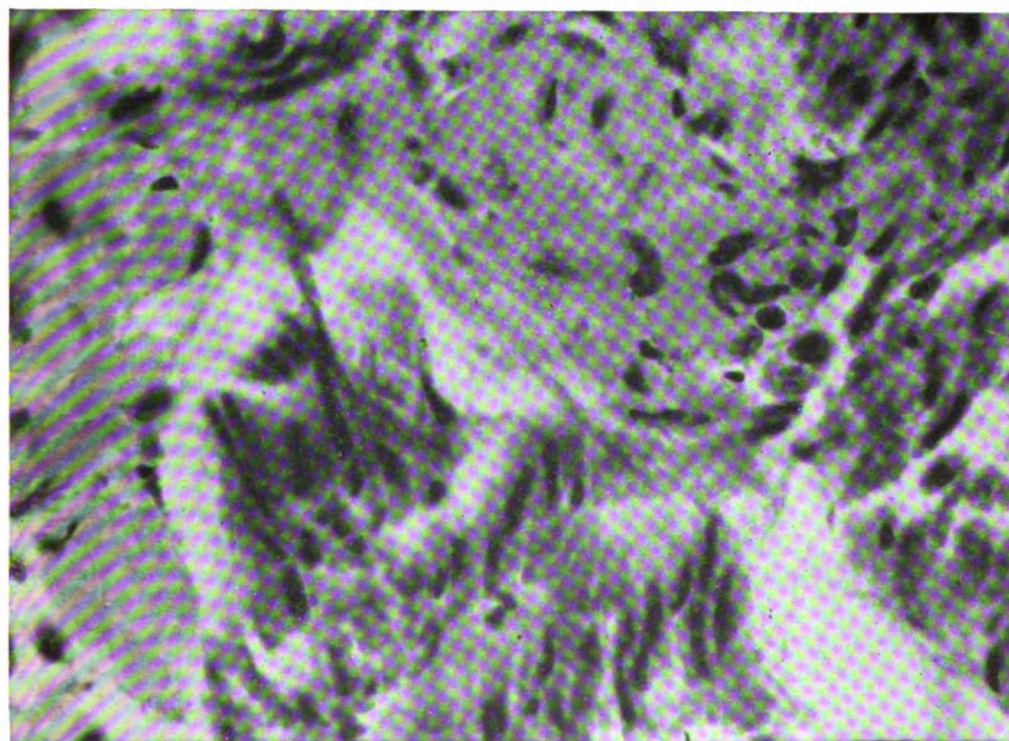


FIGURE 2.—Amyloidosis of the bladder-muscularis.

DISCUSSION

The etiology of amyloid tumors of the bladder is unknown. Because of their isolated occurrence they are probably best considered as a type of primary amyloidosis. A fairly recent discussion of primary amyloidosis of mesodermal origin is to be found in a paper by Reimann, Koucky, and Epland (6). The so-called amyloid tumors appear to have a predilection for muscle and adjacent connective tissue. Whether the amyloid material is deposited because of mechanical factors concerned with movement and vessel trauma, or with metabolic disturbances of specific types of tissue provide interesting points for speculation. Once deposited the amyloid acts as a foreign body.

The unusual nature of this type of amyloid is indicated by atypical staining reactions. Likewise, our patient's tumor contained foci of calcification as did those of Solomin (1) and Lucksch (2). Some of the amyloid tumors have been described as polypoid, others as sessile and plaque-like. All of them were indistinguishable from neoplasm, except by histologic study.

SUMMARY

A seventh case of amyloid tumor of the bladder is reported. It resembled those recently reported in that it caused hematuria, was indistinguishable on cystoscopic examinations from a neoplasm, and was treated by resection with apparent success.

REFERENCES

1. SOLOMIN, P.: Ueber locales circumscriptes Amyloid in der Harnblase. Prager med. Wehnschr, 22: 3-5, 1897.
2. LUCKSCH, HERR: Ueber lokale Amyloidbildung in der Harnblase. Verhandl. d. deutsch. path. gesellsch. 7: 34-39, 1904.
3. CHWALLA, R.: Case of amyloidosis at bladder neck resembling tumor. Urol. & Cutan, Rev. 36: 381-384, June 1932.
4. RUSCHE, C. F. and BACON, S. K.: Solitary tumor-like amyloidosis of urinary bladder. Tr. Am. A. Genito-Urin. Surgeons 34: 163-168, 1941.
5. CORBITT, R. W., BRODERS, A. C., and POOL, T. L.: Amyloidosis of urinary bladder. J. Urol. 52: 153-157, August 1944.
6. REIMANN, H. A., KOUCKY, R. F., and EKLUND, C. M.: Primary amyloidosis limited to tissue of mesodermal origin. Am. J. Path. 11: 977-988, November 1935.



TRAUMATIC ARTERIOVENOUS FISTULA OF THE SUPERFICIAL TEMPORAL ARTERY AND VEIN

REPORT OF A CASE

HARRY P. SCHENCK

Captain (MC) U. S. N. R.

Although traumatic aneurysms and arteriovenous fistulas have been frequent sequelae of vascular injuries during the present war (1), the following case report is of interest because the subjective symptoms of an arteriovenous fistula of the superficial temporal artery and vein were almost exclusively aural.

Case Report.—An officer, 22 years of age, was admitted to the hospital complaining of an intolerable pulsation and buzzing in the right ear. The symptoms had been present for 5 months. While landing on Saipan with other Marines he had been thrown to the ground by the concussion force of mortar fire, receiving a superficial wound above and in front of the left ear. He was dazed but not unconscious. A hospital corpsman reached him immediately and removed the patient's helmet in order to dress the wound near the left ear. At this time an unidentified fragment struck him above and in front of the right ear producing a lacerated wound. He was immediately removed to a ship where his wounds were redressed and at this time he noticed headache, "pounding" in the right ear, and pulsation on the right side of his head. He attributed these to the continuing action at sea and ashore and to ship's noises. When transferred to another ship several weeks later and transported to a naval hospital ashore, he realized that the "pounding" was actually in his right ear and not due to extraneous noises. The bruit in the right ear appears to have been maximal from the onset and never varied in intensity. Occipital headaches were constant from the time of injury. He had great difficulty in getting to sleep because of the tinnitus although once asleep he was not disturbed by it. Occlusion of the right ear intensified the noise. Seven weeks after injury his wounds were completely healed and he returned to duty.

Five months after the original injury he reported to the sick bay because of continued occipital headache, "pounding" and buzzing in the right ear, and pulsation on the right side of his head. The presence of an arteriovenous fistula or aneurysm was suspected and the patient admitted to the hospital for treatment.

Examination on admission showed both tympanic membranes to be intact and the external auditory canals normal. The acoustic level in each ear was normal by audiometer examination. In the right temporal region, two soft, raised, pulsating areas, each about the size of a 10-cent coin, were found to be the site of a characteristic thrill and bruit continuous through the cardiac cycle. The bruit was intense and audible to the patient as a distressing roar. Both bruit and thrill were markedly accentuated during systole. A stethoscope applied over the pulsating area indicated that the bruit was synchronous with the pulse but not interrupted or biphasic as in simple aneurysm. The bruit disappeared when firm pressure was made below and anterior to the tragus. When the hair was shaved from the right temporal region the site of the vascular lesion as

well as the course of the dilated, communicating vessels could be identified (fig. 1). No abnormalities were found in either fundus. Roentgenograms failed to reveal the presence of radiopaque foreign bodies.

A curvilinear incision, one centimeter anterior to the tragus was extended upward to the temporal region and carried forward to provide a large flap exposing the arteriovenous fistula and the dilated communicating vessels.

The proximal portions of the artery and vein were found to be dilated while the portion of the artery distal to the fistula had decreased in size. Proximal occlusion of the artery eliminated the bruit and the continuous thrill. After quadrupal ligation of the proximal and distal portions of the artery and vein, similar ligation of the parietal, frontal, anterior auricular, and transverse facial branches of the artery and vein was accomplished. The temporal and zygomatic



Superficial arteriovenous fistula of the superficial temporal artery and vein with dilated communicating vessels. Appearance after shaving hair from the involved area.

branches of the facial nerve and a portion of the auriculotemporal nerve were freed and then the dilated sac-like portions of the artery and vein at the site of the fistula and the involved communicating vessels were removed en masse. The flap was replaced, the incision closed with skin clips, and a pressure dressing applied.

On gross examination, an aneurysmal varix was found in which the blood had been able to flow directly from the artery into the vein. There was no evidence of varicose aneurysm, i. e., an indirect communication between the artery and vein by way of a sac between the two vessels. Histologically, the venous trunks showed proliferative changes in the intima, excessive supporting fibrous tissue, and only a few strands of muscle. The arterial walls showed proliferation of the intima, distortion of outline, and interruption of the inter-elastic lamina.

Where the lamina had disappeared, there was intimal proliferation, an appearance corresponding to that of an aneurysmal dilatation.

Follow-up examination 8 months after operation revealed no circulatory deficiency distal to the operated area and the patient had gained 30 pounds in weight during this symptom-free interval.

DISCUSSION

In this patient the proximity of the arteriovenous fistula to the internal ear produced subjective symptoms which became intolerable, resulted in loss of weight, and rendered him unfit for duty. The predominance of aural symptoms led the patient and several examiners to regard these as sequelae of aural trauma. Bone conduction of the bruit and perhaps transmission by way of altered vasculature to the internal ear account for the type of tinnitus. The severe, persistent headache resulted from circulatory disturbances induced by the fistula.

The high incidence of vascular and concomitant nerve injuries during World War II has been attributed to the characteristic multiple injuries produced by land mines, grenades, and aerial bombs because these tend to inflict as many as fifty or more small wounds, scattered over the body, without producing death (2). The traumatizing fragment was not recovered from the case under discussion but the resulting wound was superficial.

In general the management of superficial arteriovenous fistulas and aneurysms differs in no way from that employed in dealing with similar lesions elsewhere in the body. Their accessibility simplifies intervention. Postoperative circulatory disturbances, paralyses, gangrene, and infection due to nutritional disturbances are rare. Delay in operation in the case of small fistulas is justified on the basis that healing may occur spontaneously, but there is no need for delay in order that collateral circulation may be developed to prevent gangrene.

In the event of hemorrhage, pressure hemostasis may be necessary between the time of injury and that of operation. The artery must always be ligated both above and below because proximal ligation alone will permit blood from the collateral vessels to find its way into the fistula and thus perpetuate it. The safest procedure is the ligation of all vessels, both arterial and venous, which lead to or from the fistula and the removal of the fistula together with the ligated communicating vessels en masse. The preservation of the nerves accompanying the involved vessels is of obvious importance.

REFERENCES

1. BIGGER, I. A.: Treatment of traumatic aneurysms and arteriovenous fistulas. *Arch. Surg.* 49: 170-179, September 1944.
2. ELKIN, D. C. and WOODHALL, B.: Symposium on vascular surgery; combined vascular and nerve injuries of warfare. *Ann. Surg.* 119: 411-431, March 1944.

THE ECTOPIC KIDNEY WITH A PRESENTATION OF FIVE CASE REPORTS

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The ectopic kidney is to be properly considered as a defect in embryology. In the mammal the urinary system undergoes an almost complete recapitulation of phylogeny. The metamorphosis begins with the pronephros located in the cervical region. Before the last tubules develop, the first degenerate. All that finally remains is the ducts to be utilized by the later-appearing structures. The pronephros appears in the 9 to 10 segment embryo by the time the embryo is 4 mm. long. The mesonephros appears in the caudal end of the 5 mm. embryo to remain as the permanent excretory organ of the adult. This originates from the caudal end of the mesonephric duct. This later remains as a part of the male genital system. From this point on, the permanent kidney makes its ascent to the lumbar space due to the rapid growth of the embryo caudad. The organ may arrest its ascent any place along the route and assume its blood supply from nearby vessels.

According to autopsy records the incidence of ectopic kidney is about 1:1000, the sexes being equally susceptible. According to the records of this hospital, there were 46,786 admissions during the period from 1 May 1945 to 1 May 1946. Of this number, 1,718 urological cases were admitted, excluding venereal disease. Five cases of ectopic kidney were found, which makes 1 for every 9,357 admissions, or 0.01 percent and 1 for every 343 urological admissions or 0.29 percent. This discrepancy from the usual expectancy is hard to explain. There must be missed cases and/or because many of the hospital admissions in a naval hospital would never appear in a civilian hospital.

Cases of left-sided ectopic kidney are relatively common, right-sided cases are less common and bilateral cases are very uncommon. Only 33 cases of the latter have been reported to date. (The thirty-fourth is included in this report.)

Classifications have been proposed by Thompson and Pace of the Mayo Clinic and by Isendrath and Rolinick of Chicago. The last is simpler and preferred. According to them, the following types have been observed:

a. Lumbar.—

High—Higher than normal, usually along with a sac of a diaphragmatic hernia.

Low—To the fifth lumbar vertebra.

b. Ileo-lumbar.—

Across the crest of the ilium.

c. Ileo-pelvic.—

At the level of the ilium of the true pelvis.

d. Pelvic.—

Over the sacral promontory, concavity or floor of the true pelvis. This is the most frequent location and other locations are possible; the explanation is difficult. Dorland reports a case occurring in the abdominal wall. McArthur reports one behind the symphysis pubis.

Pathologically the ectopic kidney is usually flattened, disk-like, showing fetal lobulations and various stages of hypoplasia. Rotation has not taken place. The hilus is forward and the calices usually empty directly into the ureter without the formation of a true pelvis. Ureteral length varies but averages about 10 cm. and it is usually smaller than normal. Dependent drainage is rarely adequate because of the superior location of the ureter. The blood supply is variable in origin and anomalous. Occurrence of a long, normally arising renal artery from the aorta is rare. Adjacent vessels provide the blood supply, the lower aorta just before bifurcation of the iliac arteries. More than one artery is usually present and as many as five have been found. The same applies to venous drainage.

Such anomalously located organs are more predisposed to surgical lesions for three reasons: (1) Hypoplasia *per se*, (2) location, and (3) lack of complete dependent drainage, permitting urine stagnation. The conditions most commonly met with in their order of frequency are: (1) Hydronephrosis, (2) pyelonephritis, (3) pyonephrosis, and (4) calculus formation. Neoplasms, tuberculosis, and cysts are rarely found.

CASE REPORTS

Case 1.—A 27-year-old white male was admitted to the orthopedic service of the hospital on 25 May 1945 complaining of low back pain which appeared following an injury received in an automobile accident in July 1943. These pains came in attacks accompanied by severe headaches. No radiation of the pain had ever been present. The physical examination was essentially negative except for aggravation of the pain on forward bending, bilateral sacro-iliac tenderness, and tenderness over the right lumbar muscles. Admission laboratory studies (complete blood count, urine, and Kahn) were all normal. Procaine injection over the point of maximum tenderness and physio-therapy gave no relief. On 26 June 1945 right-sided prostatic tenderness was discovered. The teeth were x-rayed and eye, ear, nose, and throat consultation obtained. No foci of infection were reported. On 16 July 1945 an intravenous pyelogram demonstrated a normal right kidney and an ectopic left kidney located in the

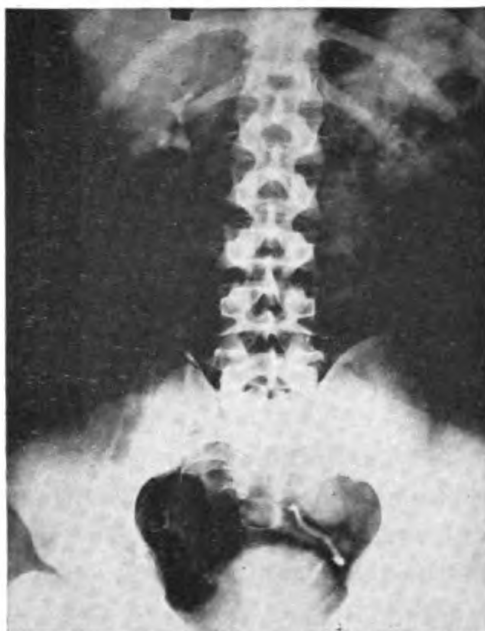


FIGURE 1 (Case 1).—Intravenous pyelogram.

quadrant of the abdomen. Admission laboratory studies (complete blood count and urine) were within normal limits. Kahn was negative. The nonprotein nitrogen was 31 mgm. percent.

On 14 July 1945 the intravenous pyelogram demonstrated a large left hydronephrotic kidney with sac formation. An ectopic right kidney lay over the sacrum. Cystoscopy was performed on 16 July 1945. The phenol-sulfonphthalein appearance time was $9\frac{1}{2}$ minutes on the left and $7\frac{1}{2}$ on the right. The 15-minute concentration was 25 percent on the left and 40 percent on the right. No additional x-ray findings were demonstrated on the retrograde pyelogram.

On 2 July 1945 an exploratory kidney exposure was performed. An anomalous vessel was found crossing the uretero-pelvic junction. This was divided, ligated, and the ureter freed. Convalescence was uneventful.

On 5 September 1945 a recheck intravenous pyelogram showed no change. The patient was discharged to duty under observation on 18 September 1945. (The x-ray plates in this case could not be found.)

Case 3.—A 21-year-old white male was admitted to the hospital on 16 October 1945 complaining of frequent

pelvis overlapping the sacrum. Cystoscopy and retrograde pyelogram verified these findings. The patient was surveyed out of the service with diagnosis of deformity, congenital, ectopic left kidney.

Case 2.—A 30-year-old white male was admitted to the hospital on 16 July 1945 with a chief complaint of pain in the left flank radiating to the left inguinal region and scrotum. Pain was first noted several months ago but did not become sharp nor severe until 7 July 1945. Low back pain and radiation of pain into the scrotum made their first appearance at this time. No frequency or dysuria noted. Besides the urological condition described, nonsevere, an appendectomy was performed in 1941.

The physical examination was essentially negative except for mild tenderness on palpation in the lower left



FIGURE 2 (Case 1).—Retrograde, pyelogram. The left kidney is demonstrated in the true pelvis. The absence of a true kidney pelvis is evident. Ureteral length measured $7\frac{1}{2}$ cm. and the capacity of the pelvis was 2 cc. of dye.



FIGURE 3 (Case 3).—Intravenous pyelogram.

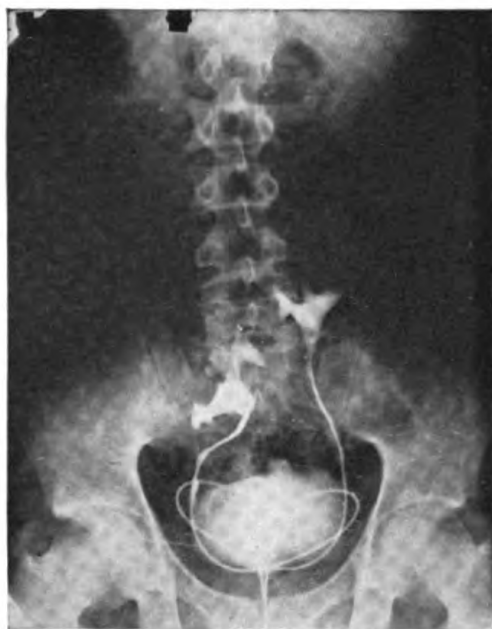


FIGURE 4 (Case 3).—Retrograde pyelogram. Bilateral ectopic kidneys are demonstrated.

urethral discharge and terminal hematuria. No pain was associated and no abdominal complaints were present. This was the only attack the patient experienced. The past medical and family histories were all irrelevant.

On physical examination an abdominal mass was palpated to the left of the umbilicus. Another mass was palpable in the right lower quadrant, crossing the mid line at L2 and L3. The prostate was normal. Blood and urine studies including a Kahn were normal.

Cystoscopy was performed on 22 October 1945. Ureteral catheters were advanced 20 cm. on the right and 15 cm. on the left. Retrograde pyelograms outlined bilateral ectopic kidneys within the bony pelvis, the right being higher.

On 30 October 1945 the patient was surveyed out of the service with diagnosis, deformity, congenital, bilateral ectopic kidneys.

Case 4.—A 30-year-old white male was admitted to the hospital on 18 March 1946 with a chief complaint of high blood pressure which was discovered on routine examination for discharge from the service. Except for the presence of albumin in the urine on one occasion, history of the present illness was essentially negative.

The patient stated that he suffered from yellow jaundice at 8, scarlatina without complications at 9, and mumps earlier in childhood. In 1943 a right herniorrhaphy and appendectomy were performed. His father died at 59 as a result of kidney trouble with edema. The physical examination was essentially negative except for a persistently elevated blood pressure 145/90 to 165/100 and an accentuation of A2; the eye grounds were normal. The admission of laboratory studies (complete blood count and urine—normal limits; and blood Kahn) were negative. On 28 March 1946 the intravenous pyelogram demonstrated a normal right kidney and rudimentary left kidney located in the region of the sacrum. A chest x-ray on 1 April 1946 was within normal limits. On 3 April 1946 the electrocardiogram was normal. Cystoscopy on 16 April 1946 allowed a No. 4 ureteral catheter to pass 9 cm. on the left and 3.5 cc. of dye were

utilized to outline the pelvis. Function studies were not done. The retrograde pyelogram outlined the kidney at the level of the first sacral segment in the mid line.

The blood pressure remained elevated and it was felt the kidney possibly was responsible. On 3 May 1946 under spinal anesthesia, through a suprapubic incision, a transperitoneal nephrectomy was performed. At operation the kidney was found to be in the left iliac fossa directly over the great vessel. Three arteries and several veins were encountered. Recovery was uneventful. Pathology report was hypoplastic kidney.

Because of very little change in blood pressure level, the sodium amytal test was done on 17 May 1946 and a basal level of 100/70 obtained. On 20 May 1946 the cold pressor caused no elevation in blood pressure after 60 seconds. On 21 May 1946 the patient went on convalescent leave. The blood pressure was 140/90.



FIGURE 5 (Case 4).—Intravenous pyelogram.



FIGURE 6 (Case 4).—Retrograde pyelogram. These films demonstrate a kidney overlying the sacral promontory.

Case 5.—A 21-year-old white male was admitted to the hospital on 25 April 1946 with a chief complaint of having had two attacks of suprapubic pain, difficult and painful defecation. The first attack was in December 1945 and the second in February 1946. No pain radiation, frequency, or dysuria noted. During each attack he was told red and white blood cells were present in the urine.

The general physical examination was essentially negative on admission. No abdominal masses were palpable. The prostate was normal in all respects. No masses could be palpated per rectum. The blood count and urine examinations were within normal limits and the blood Kahn was negative.

On 3 May 1946 an intravenous pyelogram demonstrated an ectopic kidney located in the hollow of the sacrum. The right kidney appeared enlarged.

Cystoscopy on 10 May 1946 confirmed the foregoing. The right catheter was advanced 30 cm., the left 12 cm.; urine was found normal on the right. The left

specimen showed 8 to 10 white blood cells in high-power field with no reds. The phenolsulfonphthalein appearance time was 5 minutes on the right and 4.5 on the left. In 15 minutes 40 percent was excreted on each side.

Because of the attacks of pyelonephritis, nephrectomy was advised, but the patient declined. He was discharged to duty symptomless.

COMMENT

Treatment of the ectopic kidney varies with several other factors. No didactic cook-book principle may be laid down as in some other diseases where 60 shots of penicillin suffice. Each case must be handled according to its own merits. Females of the child-bearing age are exceptions. The physiological hydroureter and hydronephrosis may cause dystocia, and vice versa the fetus may cause an exaggeration of the two conditions mentioned. Cragin reported a case which was not diagnosed until during the second stage of labor. He ruptured the kidney per vagina and delivered the woman. No one could be criticized for nephrectomizing the female in the child-bearing age group with a pelvic kidney, providing the other was normal.

The diagnosis is essential. Such cases may be admitted to any service because of the variety of symptoms observed. The symptoms produced, number of times involved in pathological process, pressure symptoms, and function must all be considered before surgery is contemplated. The condition of the opposite kidney is very impor-



FIGURE 7 (Case 5).—Intravenous pyelogram.

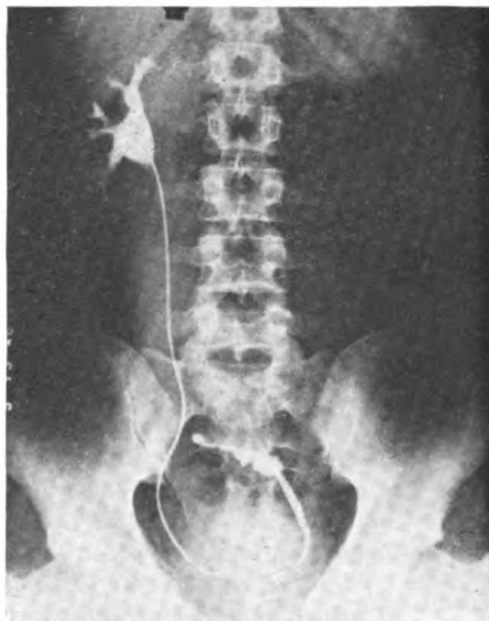


FIGURE 8 (Case 5).—Retrograde pyelogram. The kidney lies below the level of the sacral promontory.

tant. This is the middle ground, the one advocated by Thompson and Pace who have followed 88 cases clinically. Other surgeons take them all out. However, our feeling is to save the kidney as long as possible.

REFERENCES

1. AREY, L. B.: Developmental Anatomy. 4th edition. W. B. Saunders Co., Philadelphia, 1940. pp. 261-273.
2. BEER, E.: Multiple diverticula of urinary bladder, with stones. *Ann. Surg.* 83: 428-433, March 1926.
3. BRYAN, R. C.: Case of Dietl's crisis in anomalous right kidney associated with left pelvic kidney. *Surg. Gynec. & Obst.* 21: 684-693, December 1915.
4. CAULK, J. R.: Surgery of ectopic kidney. *Ann. Surg.* 78: 65-74, July 1923.
5. KEYES, E. L.: Urology. D. Appleton-Century Co., Inc., New York, 1923. p. 498.
6. DAY, R. V.: Some rare anomalies of kidney and ureter with case reports. *Surg. Gynec. & Obst.* 38: 51-57, January 1924.
7. HERMAN, L.: Practice of Urology. W. B. Saunders Co., Philadelphia, 1938. pp. 170-173.
8. EISENDRATH, D. N. and ROLINICK, H. C.: Urology. 4th edition. J. B. Lippincott Co., Philadelphia, 1938. pp. 599-607.
9. McARTHUR, L. L.: Some renal anomalies. *St. Paul Med. J.* 10: 440-445, August 1908.
10. MUNRO, J. C.: Ectopia of kidney, with report of cases. *Boston Med. & Surg. J.* 162: 415-417, March 31, 1910.
11. RANSOHOFF, J. L.: Gangrene of ectopic kidney from twisted pedicle. *Surg. Gynec. & Obst.* 30: 356, April 1920.
12. THOMPSON, G. J. and PACE, J. M.: Ectopic kidney; review of 97 cases. *Surg. Gynec. & Obst.* 64: 935-943, May 1937.
13. WALTHER, H. W. E.: Bilateral renal dystopia. *Surg. Gynec. & Obst.* 32: 83-86, January 1921.



EFFECT OF ADVANCING AGE ON DIETARY THIAMINE REQUIREMENTS

Authors' conclusions.—Thiamine requirement per g. of food rises sharply with advancing age in rats adapted to tropical warmth or temperate coolness while the absolute requirement in 2 per day advances with increasing body size. A similar rise in dietary thiamine concentration was found necessary to prevent signs of acute polyneuritis and death with advancing age and increasing body weight. At 18 months of age rats kept in tropical heat develop acute and fatal thiamine deficiency at dietary thiamine concentrations adequate to support optimal growth in temperate coolness.

The conclusion seems justified that diets for the aged or those in ill health should be thiamine-enriched to compensate for reduction in amount of food consumed. It seems probable that the same principle should be applied with the sharp caloric restriction of weight-reducing and hot weather diets.—MILLS, C. A., COTTINGHAM, E., and TAYLOR, E.: Effect of advancing age on dietary thiamine requirements. *Arch. Biochem.* 9: 221-227, March 1946.

MEDICAL AND SURGICAL DEVICES

CONSTRUCTION AND USE OF BED GYMNASIUM

VINCENT DeP. FARRELL

Lieutenant Commander (S) U. S. N. R.

The Bed Gymnasium, or "Bed Gym," designed by the author for use by bed patients in the physical-rehabilitation program at the U. S. Naval Hospital, Shoemaker, Calif., is a portable apparatus that can be moved about the wards and wheeled over a bed or a wheel chair. The various attachments are used by a patient to exercise the sound as well as the injured parts of his body.

There is no standard size for the construction of a Bed Gymnasium, the size necessarily being determined by the length and width of



FIGURE 1.—Bed Gymnasium constructed of metal pipe with attached apparatus.

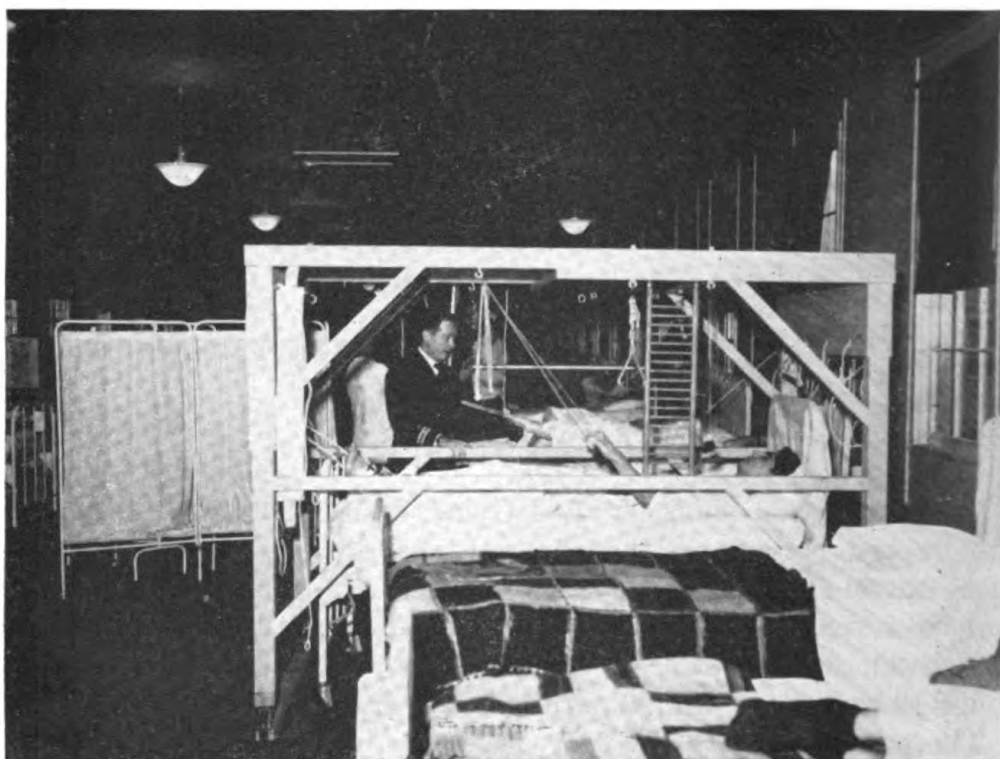


FIGURE 2.—Bed Gymnasium constructed of wood.

the hospital bed where it is to be used, the room in which it is to be used, and the height and width of the passageways through which it is to be moved. The frame may be made of metal pipe or of wood. For the metal frame 1-inch metal pipe with all joints welded and cast casters welded to the bottoms of the uprights was used. The wooden frame was made of three by threes, 8 feet 4 inches long, 4 feet 2 inches wide, and 6 feet high, with regular bed casters fitted into the uprights.

Overhead weights and foot weights are fitted on fine cables and pulleys taken from used airplane parts and the weights are those used for traction splints. For other apparatus, eye bolts placed at various angles along the top of the frame serve to attach the horizontal bar, rings, springs, etc. Because the equipment is designed for use, it can be hung over the patient's chest and removed when not in use. The same holds true for the striking bag which was made of plywood with a swivel attached in the center.

Wooden blocks 2 inches by 4 inches by 6 inches long, with a groove into which the casters fit, are used as brakes when the apparatus is in use.

For the upper and lower extremities there are foot and hand pulleys. These pulleys controlling graduated weights permit patients to ap-

proach their exercise systematically and progressively. A canvas boot attached to the leg pulley and laced on the patient's foot prevents this weight from slipping when in use. Hand, wrist, arm, and shoulder weight attachments for further conditioning are also provided. Other apparatus includes a punching bag, horizontal bar, finger ladder, dart board, and several combinations of spring attachments.

Each patient uses the "Bed-Gym" about 15 minutes each day, depending a great deal on the nature of his injury and his physical condition. The patient should increase his use of the apparatus gradually and an attempt should be made to sell him on the idea he can measure his daily increase in strength and physical tone by the number of times he can chin the bar or pull heavier weights as compared with his past performances. This idea can be furthered by arranging competition between patients whose conditions are about the same. For example, patient B can be told: "Patient A chinned ten times today; do you think you can beat him by one?"

At this hospital the "Bed-Gym" has given bed patients and others confined in wards the same chance for sound physical conditioning as enjoyed by ambulatory cases who are able to use outdoor facilities.

In addition to serving as a muscle toner in the physical sense the "Bed-Gym" has also proved of definite psychological benefit. Patients take up the challenge offered by the various exercises and the desire to improve has shortened the period of hospitalization for many.



A COMPARISON OF THE EFFECTS OF THIOURACIL AND THYROIDECTOMY ON SOME PHASES OF METABOLISM IN THE RAT

Authors' summary.—1. Both thiouracil feeding and surgical thyroidectomy reduced food and water consumption and inhibited body growth of rats. These effects occurred more rapidly and were more pronounced in the thyroidectomized group.

2. Thyroidectomy and thiouracil depressed oxygen consumption to approximately similar levels.

3. Thiouracil feeding resulted in an increased, and thyroidectomy in a decreased urine output.

4. Normal values for all metabolic phases studied in the thiouracil-treated animals were attained quickly after interruption of treatment.

5. The temporary continued release of preformed hormone from the thyroid glands of thiouracil-treated animals together with the diuretic action shown by this drug probably explain the differences encountered in the 2 groups of rats.—GORDON, A. S., GOLDSMITH, E. D., and CHARIPPER, H. A.: A comparison of the effects of thiouracil and thyroidectomy on some phases of metabolism in the rat. *The American Journal of Physiology* 146: 439–442, June 1946.

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(For review)

THE PRINCIPLES AND PRACTICE OF TROPICAL MEDICINE, by *L. Everard Napier, C. I. E., F. R. C. P., Consultant on Tropical Medicine to the Secretary of State for War; Visiting Professor of Tropical Medicine, New York University College of Medicine and Tulane University of Louisiana; formerly Director and Professor of Tropical Medicine, Calcutta School of Tropical Medicine.* 917 pages, illustrated, including a number of colored plates. The Macmillan Company, New York, publisher, 1946. Price \$11.

This is an excellent and authoritative manual of tropical medicine written by the former Director of the Calcutta School of Tropical Medicine. The book stands in point of size between the two volumes of Stitt and the single volume of Manson-Bahr. The introductory part of this work gives a valuable review of the elements of tropical hygiene and a brief survey of the climatic conditions of particular importance in tropical pathology. Following this are descriptions of all the tropical diseases, their diagnosis and treatment. There is a section devoted to tropical skin diseases and another considerable section on snakes and snake bite. This latter is accompanied by a fine table and several important helps as to the classification and identification of poisonous snakes. For nearly four centuries now tropical medicine has been assuming increasing importance and the recent world-wide war in which large numbers of men in the military services were exposed to tropical conditions has in no way lessened the importance of the subject. This book is a valuable addition to the really useful literature on tropical medicine.

HUMAN EMBRYOLOGY, by *Bradley M. Patten, Professor of Anatomy, The University of Michigan Medical School.* 776 pages, 1,366 illustrations, 53 in color. The Blakiston Co., Philadelphia, publishers, 1946. Price \$17.

This textbook has several features which should be welcomed by the medical student and physician. In the first place it is on human embryology and a departure from the pig and chick embryology which

is the usual subject for the student of biology. Secondly, Dr. Patten has constantly brought into the story the application of the embryological development to physiology and clinical medicine. The development of the skeleton and the section devoted to teratology and abnormalities of development are particularly excellent. The earlier chapters dealing with the sexual cycle, the formation of the germ layers, and the establishment of the organ systems are also very fine.

The illustrations are excellent and most of them are original. A number are colored.

The concluding section of the book deals with the lymphatics and the cardiovascular system. This is one of the most interesting parts of the work for it includes a description of the origin of developmental defects of the heart, a subject on which Dr. Patten has done much original and valuable research. The book will meet with immediate acclaim by student, teacher, and physician, and is a most creditable contribution to American anatomical literature.

MODERN MANAGEMENT IN CLINICAL MEDICINE, by *F. Kenneth Albrecht, M. D., and Senior Assistant Surgeon, U. S. Public Health Service*, 1238 pages, illustrated. The Williams & Wilkins Co., Baltimore, publishers, 1946. Price \$10.

Although the title suggests that the book is primarily a work on therapeutics this is really a textbook on the practice of medicine. Symptoms and diagnosis are very carefully considered even though the emphasis is on treatment.

In every way it is a practical book, each subject being covered in a plain and concise manner. There is a good section on nervous and mental diseases and another on the common skin diseases, both subjects with which the internist is very greatly concerned. Another interesting and timely section is one devoted to geriatrics. The care of older age groups is becoming of increasing importance and geriatrics can well form a part of any textbook of clinical medicine.

Another practical feature is the inclusion of a number of the most significant laboratory tests. Some excellent diet lists and a very careful description of the technique involved in such common procedures as thoracentesis, blood transfusions, and other diagnostic or therapeutic measures of this character form a valuable section of the book. Illustrations are numerous and good, and there are a number of excellent tables and a good index.

AMERICAN POCKET MEDICAL DICTIONARY, by *W. A. Newman Dorland, A. M., M. D.* 18th edition. 1061 pages, no illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1946. Price \$2.50.

This is a compend of Dorland's large standard medical dictionary and like that well-known book presents an authoritative as well as brief definition of medical words. Although not illustrated, there are

a number of valuable tables and these are well indexed. The definitions though made as short as possible are sufficient for most purposes. The thumb index feature is retained. The book is a little bulky to be classed as a pocket dictionary. A pocket would bulge very markedly with so chunky a volume. As a medical lexicon of convenient size however it is strongly recommended.

A HISTORY OF MEDICINE, by *Douglas Guthrie, M. D., F. R. C. S.* 448 pages, 72 plates. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1946. Price \$6.

It is unfortunate that the importance of the history of medicine is only just beginning to be realized by the medical profession. Yet the historical approach is the only true and proper approach to any science or any profession. One of the greatest thinkers of modern times has declared that "the history of a science is the science itself." A great deal of futility in science and medicine and a great many pitfalls would be avoided if a sound knowledge of the history of the sciences and of medicine was taught in the universities. It was Mr. Winston Churchill in an address to the Royal College of Physicians who remarked that "The longer you can look back, the further you can look forward." Yet in spite of this truth it is unfortunate that only a few medical colleges have chairs in the history of medicine or give in the curriculum the space which it deserves.

This short history of medicine by a distinguished Professor of Medical History in one of the Scottish universities gives a clear and philosophic picture of medical practice from ancient times to our own day. Particularly fine are the descriptions of Hippocratic medicine and of the Arabian School. The book is based on a chronological rather than a biographical plan but does contain many interesting sketches of personalities and many portraits. The development of scientific medicine since the Renaissance is well described, and as is quite natural, there is a great deal of emphasis on the great Scottish physicians and surgeons of the eighteenth and nineteenth centuries. There is a brief history of military and naval medicine and also a history of medical journalism and of medical history itself. In the appendix is a useful list of books dealing with subjects in the various fields of medical history. The illustrations though not numerous are excellent. A physician who wishes a brief but interesting survey of medical history can do no better than add this book to his library.

AUTOPSY DIAGNOSIS AND TECHNIC, by *Otto Saphir, M. D., Professor of Pathology, University of Illinois Medical School, Chicago.* 2d edition. 405 pages, 69 illustrations and 18 tables. Paul B. Hoeber, Inc., New York, publishers, 1946. Price \$5.

This is an excellent little book already well known to the medical profession, the original edition having been published nearly 10 years

ago. As in the first edition, the primary emphasis has been on the description of the effects of disease as shown in definite anatomic lesions after death.

This edition contains considerable material on the diseases of the breast and also on the pathological findings in stillborn infants. The anatomic findings in some of the tropical diseases and the vitamin deficiencies have also been emphasized. The book is outstanding as to such features as the autopsy permit, social and religious implications in autopsy work, and the careful descriptions of post-mortem technique.

CARBOHYDRATE METABOLISM, by *Samuel Soskin, M.D., Director of the Research Institute, Michael Reese Hospital, and Rachmiel Levine, M.D., Director of Metabolic and Endocrine Research, Michael Reese Hospital.* 315 pages, many graphs and tables. University of Chicago Press, Chicago, Ill., publishers, 1946. Price \$6.

The reviewer had the privilege of reading this book in conjunction with a new book on the clinical phases of diabetes and found that it supplemented that work perfectly. Dr. Soskin and Dr. Levine have aimed to correlate the biochemical and clinical features of carbohydrate metabolism. The disturbances involving the adrenal, the pituitary, and thyroid are dealt with as thoroughly as that of the pancreas. A chapter of much interest is one on the experimental production of diabetes. Good lists of references are at the end of each chapter. For the physiologist, endocrinologist, and internist, this is a most valuable work and it is an essential book for the research worker in the field of carbohydrate physiology.



PREVENTIVE MEDICINE

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NOTE.—The report, *Toxic Effects of Arsenical Compounds as Administered in the United States Navy*, which usually appears in the October issue of the U. S. NAVAL MEDICAL BULLETIN, will appear in the November number.

THE RAT POPULATION OF A NEWLY ESTABLISHED MILITARY BASE IN THE SOLOMON ISLANDS¹

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During the war, personnel at military bases in the Pacific area were exposed to a certain amount of annoyance and to an actual or potential health hazard resulting from the local rat population. The details varied from place to place, according to the kinds of rats, the densities of their populations, local conditions of climate and terrain, and the kinds of human activities that were carried on. The large-scale clearing, grading, building, and transporting and storing of supplies that accompanied the establishment of a modern military base had profound effects on the hitherto more or less stable populations of rats. As a result of the new conditions, some species increased in numbers, others decreased, and still others were introduced and became established for the first time.

An account of the rat situation as it was observed in 1944 at one newly established base in the Solomon islands is presented here, not only because of its unusual features, but also because it provides a fairly typical picture of what took place at many bases in that part of the world during the war.

When American forces established a beach head at Cape Torokina, on the western coast of Bougainville Island, late in 1943, they invaded an area that had been little influenced by modern civilization. The sparse human population consisted chiefly of Melanesian natives living in a series of small villages along the shore, together with a few white missionaries and the recently arrived Japanese army patrols. There were some small coconut groves, but no permanent ports or harbor installations. Behind the beach there was almost unbroken jungle. In subsequent operations a segment of the island was converted into a large military base and sealed off from commerce with the remainder

¹ Observations recorded here were made under the auspices of U. S. Naval Medical Research Unit No. 2.

of the island by a perimeter of combat zone. All supplies and equipment were imported by ship, and to a relatively small extent by airplane, from outside bases.

At the time of the invasion the native rat population included only two species that are significant in the present discussion: The small Pacific island rat, *Rattus exulans*, and a larger native species, *R. praetor*. Other native ratlike rodents known to inhabit the island played no significant part in relation to the welfare of the base. The common ship rat, *R. rattus*, was introduced with the American invasion but neither the brown rat, *R. norvegicus*, nor the house mouse, *Mus musculus*, had appeared within a year afterward.

RATTUS EXULANS BROWNI ALSTON

This is a commensal species which plays a part in the native villages analogous to that of *R. rattus* and *R. norvegicus* in the larger ports and cities throughout the world. It is much smaller than the "European" rats, having a total length of about 225 mm. The tail is approximately as long as the head and body combined, and in the Solomon islands race the fur is thickly set with flattened spinous hairs. The color above is gray or dusky brown, the underparts are white or grayish-white, usually with an irregularly shaped brown spot on the chest. The female has two pairs of axillary and two pairs of inguinal mammae. This is the local representative of a distinctive group of subspecies or closely related species, sometimes called the *R. concolor* group, which occurs in association with native human cultures throughout the Malayan, Melanesian, Micronesian, and Polynesian areas.

Before the American occupation these rats lived in and about the native villages, but they did not inhabit the dense jungle far from human habitations. They readily adapted themselves to life in the military camps, but their rate of reproduction was too slow to enable them to keep pace with the rapid expansion of the base. When observations were first made, 8 months after the invasion, many of the camps 2 miles or more inland reported no rat infestation. Spread of this species through the base seemed to be a process of slow diffusion, hastened here and there by the accidental transportation of individuals from one camp to another, possibly in packing cases. Eleven months after the invasion, all sections of the base, and probably all individual camps, were infested with these rats.

Once the rats had obtained access to a camp, the speed with which they built up a troublesome population and the extent of the damage they did depended on the local conditions of food supply and shelter. Living quarters, commissary tents, galleys, and mess halls pro-

vided the best foraging grounds. Most of the men kept apples, candy, peanuts, and chewing gum in their tents, and in spite of the best efforts of sanitary and commissary officers the rats could obtain access to stored rations or find enough waste food and garbage to support a fair population. Their small size enabled these rats to squeeze through holes and cracks too small to admit the larger species.

Availability of shelter for nesting and hiding was an important factor. These rats are fairly generalized in their habits, being able to dig burrows as well as to climb, and they took advantage of a variety of situations. The usual type of log-and-earth bomb shelter, especially when out of use for some time, provided convenient hiding places. Nests were built and young were reared in closets and lockers improvised by the men in their living quarters. Burrows were dug under platforms and temporary floors. One Army company camped near the beach and early exposed to infestation by the rats had very little trouble as long as the quarters consisted of simple pyramidal tents without floors. In order to reach food in the tents, the rats had to cross from 20 to 50 yards of open sandy ground from the shelter of bordering vegetation. When crude floors consisting of wooden sections laid flat on the ground were installed, the rats dug burrows under the floors, moved permanently into the camp, and soon became a nuisance. Floors raised a foot or more off the ground offered scant protection to the rats.

This species has a lower reproductive rate than *R. rattus*. The number of embryos in pregnant female *R. exulans* varied from 2 to 8, with an average of slightly below 5. The rats were not noticeable about camps until families of young were produced. The sudden appearance of numbers of small rats recently out of the nest gave rise to reports of outbreaks of "mice."

R. exulans was found at different places in association with *R. rattus* and *R. praetor*, and apparently held its own in competition with them. Perhaps its generalized habits allowed this rat a wider selection of habitats and its small size allowed access to food supplies and to hiding places that were barred to the larger and more specialized rats.

RATTUS RATTUS LINNAEUS

This rat, in its various color phases, is well known as an associate of man in most of the warmer parts of the world, having accompanied the spread of Western civilization to nearly every port where ocean-going ships call. The essential characters for its recognition are large size (total length averaging about 400 mm.), long tail (appreciably longer than head and body), and large bare ears. The

local population exhibited three color phases characteristic of ship-borne rats of this species: (1) Back brown, belly white; (2) back brown, belly dark gray; and (3) back and belly both dark gray (the "black" rat). These are the so-called subspecies *frugivorus*, *alexandrinus*, and *rattus*, respectively. Except for the differences in color, these types have no morphological distinctions, and ecological differences said to have been observed at other places did not exist in this population. A litter of young included both white-bellied and black individuals in the same nest.

The first rats were introduced soon after American troops arrived. Puruata Island, approximately one-fourth mile in diameter and lying one-half mile off Cape Torokina, was used in part as a ration dump early in the invasion, supplies being landed directly on the shore from beached landing ships of the LST type. The ships remained on the beach with their ramps down for days or weeks at a time, thus giving rats easy access to the island, where ample food was available around the ration dumps. Surf conditions prevented frequent or prolonged beaching of ships on the adjacent shore of Bougainville Island, and no docks were constructed. Supplies and equipment of all kinds were brought ashore from ships anchored in the harbor by amphibious trucks and by small landing craft acting as lighters. Operations of the latter type minimized the opportunities for rats to get ashore.

The *R. rattus* population was thus restricted for several months to Puruata Island. Eventual seeding of the main base on Bougainville Island proper was inevitable, however, considering the great amount of supplies brought ashore from ships and the volume of daily boat traffic from heavily infested Puruata Island. The first authenticated occurrence of the species on the main island was detected on July 25, about 8 months after the invasion, but several local introductions had probably been made by this time. In the succeeding 4 months this species appeared with increasing frequency at camps as far as 5 miles inland. The preponderance of young individuals among the rats that were trapped suggested that these colonies were multiplying rapidly.

The number of embryos in pregnant females varied from 4 to 11, with an average near 9. A nest containing a litter of young rats on Puruata Island was situated approximately 3 feet above the ground in the decaying center of a palm stump. This rat is a good climber, but there was no evidence that it digs burrows in the ground. Two native species of snakes (*Engyrus carinatus* and *Boiga irregularis*) with semiarboreal habits were found to have young *R. rattus* in their stomachs.

RATTUS PRAETOR MEDIOCRIS TROUGHTON

This is a fairly large and heavy-bodied rat having approximately the same body proportions as the common brown rat (*R. norvegicus*). It may be distinguished from the latter by having darker color, shorter and more spinous fur, more darkly colored feet and tail, and, in the female, only four pairs of mammae (two axillary and two inguinal) rather than six pairs. There is usually an irregularly shaped white patch or stripe near the midline on the chest or belly. Adult males average near 355 mm., adult females near 310 mm., in total length; the tail is shorter than the head and body.

R. praetor is restricted to the Solomon Islands and perhaps the Bismarck archipelago. Related species occur in New Guinea, the Moluccas, and tropical northern Australia. Together they comprise the *R. leucopus* or *R. ringens* group of rats.

In the vicinity of Cape Torokina, *R. praetor* was relatively rare. Apparently it is a strictly wild species, only incidentally coming into contact with human cultures. An apparently isolated colony was found at the mouth of the Jaba River, 10 miles south of Cape Torokina, where a temporary Army outpost had been set up. The rats were most abundant in a low-lying semimarshy area bordering a small lagoon and in the adjacent jungle. They had burrows in sandy soil on slightly elevated ridges covered with jungle between the marshy areas. At night the rats forage in considerable numbers about pill boxes and dugouts occupied by troops. At that place they seemed to outnumber the smaller *R. exulans*. *R. praetor* was rare at other places on the base.

There is strong circumstantial evidence that *R. praetor* played a part in the epidemiology of tsutsugamushi diseases or scrub typhus that broke out among troops at the Juba River outpost. The site of the rat colony coincided with the area where the disease was contracted, and the rats were heavily infested with the chiggers of trombiculine mites suspected of carrying the disease.



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Veseen, Leslie L., Captain (MC) USNR (*The Ectopic Kidney With a Presentation of Five Cases*, p. 1614). M. D., Loyola University School of Medicine, 1920. Intern, Alexian Brothers' Hospital, Chicago, Ill., 1920-22; assistant to Professor Louis E. Schmidt, Chicago, Ill., 1920-27; associate in urology, Northwestern University Medical School, 1926-; attending urologist, Cook County Hospital, Chicago, Ill., 1927-; chief of urology, Passavant Memorial Hospital, Chicago, Ill., 1936-; professor of urology, Cook County Graduate School of Medicine, 1939-. Member: American Medical Association, American Urological Association, Chicago Urological Society, Chicago Medical Society, and Illinois State Medical Society.

Watson, Robert I., Lieutenant Commander, H(S) USNR (*The Usefulness of the Cornell Selectee Index at the Neuropsychiatric Unit of a Naval Training Center*, p. 1583). A. B., Dana College, 1933; A. M., 1935, and Ph. D., 1938, Columbia University. Psychological assistant, New Jersey State Hospital, Marlboro, N. J., 1931-32; assistant in psychology, Dana College, Newark, N. J., 1932-33; instructor in psychology, University of Newark, Newark, N. J., 1933-38; assistant professor, head of department of psychology University of Idaho, Southern Branch, Pocatello, Idaho, 1938-41; instructor, Student Personnel Bureau, City College, College of the City of New York, 1941-42. Fellow American Psychological Association.

Weinstock, Harry I., Captain (MC) USNR (*The Usefulness of the Cornell Selectee Index at the Neuropsychiatric Unit of a Naval Training Center*, p. 1583). A. B., Columbia University, 1920; M. D., Columbia University College of Physicians and Surgeons, 1923. Intern, medicine, Mount Sinai Hospital, New York, N. Y., 1923-25; Escherisch Fellow in pathology, Mount Sinai Hospital, 1925-27; post-graduate work in endocrine physiology and neurology at Physiologisches Institut, Hamburg, Germany, 1927-28; assistant in neurology and endocrinology, Vanderbilt Clinic and Cornell Clinic, New York, N. Y., 1928-30; extern in psychiatry, Psychiatric Institute, New York, 1931; training at New York Psychoanalytic Institute, 1931-33; instructor, Psychiatric Institute, 1932-36; adjunct psychiatrist, Mt. Sinia Hospital, New York, N. Y., 1936-42. Member: New York Psychoanalytical Association, American Psychoanalytical Association, International Psychoanalytical Association, American Psychiatric Association. Diplomate American Board of Psychiatry and Neurology.

Young, Donald C., Commander (MC) USNR (*Secondary Infection of Dermato-phytosis*, p. 1604). M. D., Wayne University College of Medicine, 1925. Intern, City of Detroit Receiving Hospital, Detroit, Mich., 1925-28; Chief physician, 1928-40, and medical director, 1940-42 and 1945-46, communicable diseases division, Herman Kiefer Hospital, Detroit. Member: American Medical Association, Michigan State Medical Society, Wayne County Medical Society, Detroit Pediatric Society, and American Public Health Association.



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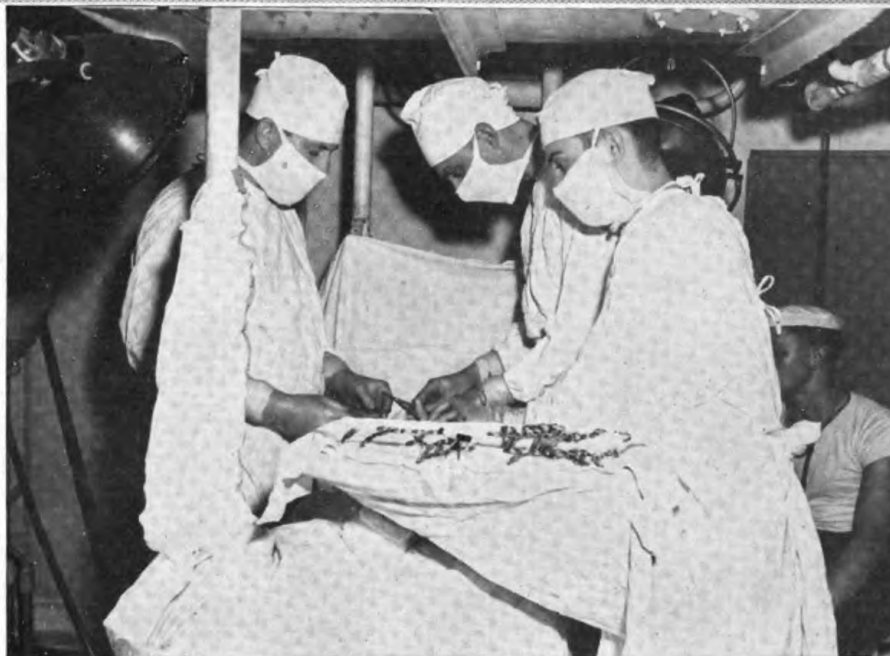
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NUMBER 11



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COVER PHOTOGRAPH

Operation "Operation" might well be the title for the upper picture on the cover while the lower picture shows postoperative treatment in a hospital ward. The upper picture was taken at a battle dressing station on board ship during combat off Okinawa.

—Official U. S. Navy Photos.

VOL. 46

NOVEMBER 1946

NO. 11

UNITED STATES NAVAL MEDICAL BULLETIN

THE MISSION OF THE MEDICAL DEPARTMENT OF THE NAVY
TO KEEP AS MANY MEN AT AS MANY GUNS
AS MANY DAYS AS POSSIBLE



MONTHLY

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BUREAU OF MEDICINE AND SURGERY

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NAVY DEPARTMENT,
Washington, March 20, 1907.

THIS UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.



Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

All numbers up to and including 1921.

Volume 16, 1922, Nos. 4 and 5.

Volume 17, 1922, Nos. 4 and 6.

Volume 18, 1923, Nos. 1, 2, 3, and 5.

Volume 19, 1923, Nos. 2 and 3.

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PREFACE



The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying Medical Department personnel of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Nurse Corps in 1908 and the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of those Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine and dentistry, editorial comment on current literature of special professional interest to Medical Department personnel, clinical notes on interesting cases, descriptions of suggested devices, reports from various sources, notes and comments on topics of professional interest, and notices of newly published professional books.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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NOTICE TO CONTRIBUTORS



Contributions to the *BULLETIN* should be typewritten, double-spaced, on plain paper and should have wide margins. Fasteners which will not tear the paper when removed should be used. Nothing should be written in the manuscript which is not intended for publication; for example, addresses and dates, not a part of the article, require deletion by the editor. The *BULLETIN* endeavors to follow a uniform style in headings and captions.

Accuracy and completeness should be employed in all citations (references, bibliography, etc.) as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify the publications and quotations cited. The style used in the *BULLETIN* should be followed as closely as possible. The author of an article is considered responsible for the accuracy and completeness of bibliographical references.

The editor is not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to the Bureau of Medicine and Surgery in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

LOUIS H. RODDIS, *Editor*,
Captain, Medical Corps,
United States Navy.

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U. S. NAVAL MEDICAL BULLETIN

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NOVEMBER 1946

NO. 11

SPECIAL ARTICLES



THE WARTIME LOG OF A UNITED STATES NAVY HOSPITAL SHIP TO 30 JUNE 1943¹

Part I

MELVILLE J. ASTON

Captain (MC) U. S. N.

and

RICHARD A. KERN

Commodore (MC) U. S. N. R.

On August 9, 1941, the U. S. S. *Solace* was commissioned, the sixth hospital ship in our Navy since such vessels have been subject to the terms of the Hague Convention (1907), and the second to bear the name *Solace*. On the day of commissioning, the first patient was admitted on board. Patient number 10,000 was entered on the Register of Patients June 16, 1943. Since a register number is permanently assigned to an individual and serves him during subsequent admissions, the number of actual admissions is greater than the register number of individuals admitted, and totals 10,802 at the time of writing, August 1, 1943. Of these, only 573 were prior to, and 10,229 after December 7, 1941; the record of the *Solace* is therefore truly a wartime log. Those admissions began with Pearl Harbor, they continued at various islands of the South Pacific, they comprised casualties

¹ This is the first in the series of four parts in which this article will be published. The second, third, and fourth parts will appear in succeeding issues of the BULLETIN, with references following Part IV.

Part I relates largely to the history and movements of the *Solace* for the period covered by the article and Parts II, III, and IV to the professional activities during the same period.

from most of the sea, air, and land actions in that area, including Coral Sea and various battles of the Solomons. One of the authors, M. J. A., began his tour of duty when the casualties of Pearl Harbor were still on board; the other has been present during the last 9,400 admissions. Our service has therefore covered a considerable range of activities, largely new and all under the conditions of war. So it seems justified to put on record certain of these experiences and the opinions and recommendations which they inspire.

THE MISSION AND FUNCTION OF A HOSPITAL SHIP

Navy Regulations is cautiously vague in defining the purposes of hospital ships. It is directed in Article 665 that hospital ships be "employed for the purpose of caring for, treating, and transporting the sick and wounded of the Navy, Marine Corps, and Army, as well as shipwrecked and other persons requiring medical service."

These are generalities. What actually have been the functions of this ship in wartime? They may be summarized under the five headings: (1) A floating mobile hospital, serving with concentrations of naval vessels; (2) A mobile out-patient department, affording medical consultative and examining facilities; (3) An evacuation vessel, conveying the sick and wounded from advanced areas to medical facilities in the rear; (4) A mobile medical supply depot, furnishing urgently needed medical supplies to ships and medical activities in outlying and advanced locations; and (5) The training of Hospital Corps personnel, including the certification of various kinds of medical technicians.

To serve as a floating mobile hospital, that ministers to the medical needs of a naval fleet or lesser group of ships, is and remains the primary function of a hospital ship. In peacetime this, together with its outpatient facilities, is virtually its only function. In that capacity, not only can the hospital ship provide all the benefits of a modern hospital to a group of naval vessels by its presence at their operating base, but also, in case the fleet shifts to another base, it can, by proceeding to that new base, assure the continuity of such hospital service, especially the prompt return of recovered patients to their own ships.

The value of a hospital ship to the fleet which it serves was strikingly shown at Pearl Harbor on December 7, 1941. The medical part of that story (there were admitted that day 147 patients, and many others were given emergency treatment and returned to their ships) has been told elsewhere under the fitting title, "*The Solace in Action*" (1). But the significance of that chapter of the ship's history is best summarized in this communication:

The Commander in Chief, U. S. Pacific Fleet, takes pleasure in commending
U. S. S. *SOLACE*

For services set forth in the following

CITATION:

For meritorious achievement and distinguished service during and subsequent to the Japanese air attack on the U. S. Pacific Fleet at Pearl Harbor, Territory of Hawaii, on December 7, 1941. At the time of the attack and afterwards, this unit displayed conspicuous devotion in the line of duty. Its ability to cope with this disaster was responsible for the successful care of all casualties and the saving of many lives. The professional skill displayed and distinguished service rendered by this Hospital Ship were in keeping with the highest traditions of the Naval Service.

C. W. NIMITZ,
Admiral, U. S. Navy.

HISTORICAL

For 3 months the *Solace* continued to serve as the hospital ship for a fleet that was licking its wounds. Then, as naval strength moved southwestward, the *Solace* followed in its wake, coming to anchor in a succession of harbors that served as advanced bases.

On the first leg of the voyage, the *Solace* "crossed the line." A small group of about 25 shellbacks found itself confronted with the task of initiating a shipful of pollywogs into the Mysteries of the Deep. They did so efficiently and with a will. The pollywogs, in anticipation of the arrival of the Royal Party of Neptunus Rex, swept and swabbed and drilled and stood look-out watches, peering through binoculars made by lashing together two specimen glasses. Davy Jones, Secretary to His Majesty, Neptunus Rex, came aboard in due time, acquainted the commanding officer with the failings and offenses of the pollywogs and ordered them, officers, nurses, and crew, to appear before Neptunus Rex. That royal personage and his party, consisting of Her Royal Highness, Queen Amphitrite; the Royal Baby; the Royal Navigator; the Royal Scribe; the Royal Doctor; the Royal Surgeon; the Royal Dentist; the Royal Barber; the Royal Judge; the Royal Chaplain; Peg Leg; attorneys, bears, police, and mourners arrived and were received in state.

Neptunus Rex took command and proceeded to hold court, while his judge passed sentence on each pollywog who then had to pay the penalty of his crimes: A bow (aided by the wallop of a paddle) to her Royal Highness, Queen Amphitrite; a kiss (on the not-so-immaculate diaper) for the Royal Baby; an examination by the Royal Doctor (who sprayed his throat with nothing pleasanter than hydrogen sulfide); an operation by the Royal Surgeon (whose knife carried an electric charge); the dead victim then being placed in the coffin (where he was wept over by the mourners and resurrected by

the fire hose) ; running a gauntlet of paddles to the chair of the Royal Barber where he was lathered with flour paste applied with a white-wash brush and shaved with a wooden razor. Followed a tip of the barber chair, a ducking in the canvas pool, and repeated dunkings which ceased only with the presentation of the magic word, —. From these few hints, the reader may understand just why every shellback treasures the magnificent certificate that he receives on achieving that privileged degree.

The first stop was at a little tropical island (Tutuila, American Samoa) whose beauty is entrancing, so long as one can contemplate it passively—and therefore coolly—and within short sprinting distance of shelter against the more than 200 inches of annual rainfall. The duty there was not heavy, leaving time for frequent excursions to the beach, where medical and sociological problems vied with enchanting scenery and the burst of activity of the “Rainmaker” to fix our attention. The “Rainmaker” is a sugar-loaf mountain at the entrance to the harbor, where it is the first to meet the moisture-laden trade winds. Its peak, perhaps 800 or 1,000 feet high, is therefore almost constantly wreathed in clouds that stream out to leeward across the harbor and, on the slightest or no provocation, deluge the land with innumerable sudden showers, running about six drops to the quart.

“Take equal parts of two nice peoples, white and brown; mix suddenly and intimately; close your eyes and hold your hands over your ears, while awaiting the explosion * * * open your eyes and see what, if anything, had happened.” With these words Captain Robert P. Parsons (MC) U. S. N. (10) opens his delightful article recently published in the Atlantic Monthly, “The Marines have landed,” in which he describes the sociological problems created by the garrisoning of our island.

Quite as interesting were the medical problems which the situation raised. Chief among these was filariasis. Its occasional and late outward manifestation, elephantiasis, present in one out of every 50 adults and in most of the elderly on the street, showed how common, well nigh universal, the infection must be among the native population. When medical officers stationed on the island, were asked, “Have you seen any whites with filariasis?” they always answered: “Only one, a man who married a native girl and went native himself.” Yet “going native” is the term that closely describes the conditions under which the Marines lived in the native villages, their tents close by the native huts, as Captain Parson’s article well portrays. It therefore seemed to us highly probable that the numerous *Aedes* mosquitoes would make no distinction between Marines and natives, and so would eventually transmit filariasis to the Marines as well. It had not yet happened when we were there, for contact was yet too recent. But it has happened

during the year and more that has elapsed since then. (This will be discussed later under Medical Considerations.)

Here many of us saw our first cases of yaws. After a few visits to the out-patient clinic of the little naval hospital, we were able to recognize at a glance the scars of healed lesions on the feet and legs of the children as they passed us on the road. Here too, some of us saw our first cases of leprosy, a dozen patients in various stages of the disease.

After a month the *Solace* moved on to a new base, in the harbor of the largest of a group of islands that must also remain nameless (Tonga Tabu). Captain Parsons spoke of the other island as Elysia, and said that the Elysians were probably the happiest people in the world. If this be true, it is at least equally so of Utopia and the Utopians. In fact, we would without hesitation award the palm to Utopia and its people for a number of excellent reasons.

The Utopian islands are near the outer margin of the torrid zone. Their climate comes nearer to perfection than any we have encountered; an equable temperature; a moderate rainfall that is distributed almost evenly through the year; dependable trade winds and only the rarest of hurricanes, say once in 10 years. There is a bountiful supply of the same foods that are found in Elysia.

The Utopians are blood brothers of the Elysians, and like them are a kindly, friendly people. Physically, they are fine specimens, especially those of chieftain rank among them, and they enjoy even better health than the Elysians. Filariasis is uncommon, there is little tuberculosis, and leprosy is rare. Yaws is fairly frequent and, as usual, fairly innocuous. Venereal disease is rare, an importation by the foreigner. Up to the time of the entrance of the United States into the war, there had been very little contact between these islands and the outside world beyond a monthly visit by an inter-island steamer that brought supplies and took away bananas and copra. The hazards of war, however, included venereal disease that furnished the opportunity for some of our staff to study the local use of microcrystalline sulfa-thiazole in the treatment of gonorrhea in the female among the Utopians. The report of these observations appeared in the United States Naval Medical Bulletin (14).

The Utopians have achieved a higher rung on the social, economic, and political ladders than have the Elysians. They have their own kingdom, the only independent nation in this part of the world, over which their queen rules well and wisely, with a little guidance under the protectorate of a European power. A parliament, a third each of whose members are respectively appointed by the queen, and by the hereditary Nobles, or are elected by the people, makes the laws. Lest anyone question our selection of the pseudonym Utopia for this little

kingdom, be it known that it has a balanced budget and no national debt.

Our work here was often light, so that on occasions we were able to enjoy the beauties of the islands and the hospitality of the friendly people. We cherish pleasant recollections of colorful native villages and glorious sunsets; of coral reefs, "blow holes," and "flying foxes" (large fruit-eating bats with a wing-spread of up to 4 feet); of tapa cloth and fine mats; of the little golf course whose major hazard was the royal tombs in the center; of ceremonial feasts of roast pig, chicken, fish, taro, and yams, cooked in banana leaves in holes in the ground and eaten with all hands sitting cross-legged on the deck; of ancient tombs and monoliths; of the consul and his staff and his tennis courts; of the white district physician, his native medical practitioners and nurses, and of "B Flat," his number one house-boy; of cheerful, pleasant, dignified natives; of parliament, and oratory that was impressive even though couched in an unknown tongue; of the queen herself, a queen, indeed, every inch of her 6 feet 3 and every ounce of her 300 pounds, who traces her genealogy back through 9 centuries.

These are more pleasant memories to dwell on than the alerts and the blackouts, the burned and wounded that came back to us from the battles of the Coral Sea, the little Army and Navy Cemetery where we laid to rest our honored dead.

In early August 1942, began the offensive in the Solomon Islands. In anticipation of it by a few days, the *Solace* moved forward to a new base. Here she continued at intervals to carry out her primary mission as a hospital and as an out-patient department for naval personnel afloat. These duties have varied widely in degree with the number of ships and men in the area. They have also alternated with periods during which the ship was performing the functions of an evacuation vessel.

Whenever the *Solace* was at her base port, the calls on her services were numerous. This was particularly true of certain departments, notably the eye, ear, nose, and throat department and the dental section. Thus during a single month the former handled a combined total number of in- and out-patients that reached 2,293. Lest the reader has been led to think too much along nonmedical lines, we insert at this point some figures that give an over-all picture of how the ship's company of the *Solace* put in most of their time. (See table 1.)

These figures mean more when one considers the number of the personnel that did the work. From the time of commissioning of the ship until late December 1942, a period during which approximately 7,000 patients were admitted, the medical staff consisted of the Medical Officer, with administrative duties, 12 medical officers

with clinical and laboratory duties, 2 dental officers, at first 3, later 4 pharmacists, a chief nurse and 12 duty nurses, and about 140 hospital corpsmen. Since December 1942, the personnel has been gradually augmented, so that now there are 16 medical officers with clinical and laboratory duties, 3 dental officers, 1 chief nurse, 20 duty nurses, and 161 hospital corpsmen.

TABLE 1.—*Summary of certain medical activities on the U. S. S. "Solace" from Aug. 9, 1941, to June 30, 1943*

Total patients hospitalized	10,472
Total sick days	69,875
Major operations	1,160
Minor operations	304
Casts applied	474
Eye, ear, nose, and throat operations	591
Eye, ear, nose, and throat treatments	7,432
X-ray examinations and treatments	5,475
Laboratory examinations	49,876
Physiotherapy treatments	12,755
Electrocardiographic studies (since Nov. 22, 1941)	184
Basal metabolism estimations (since July 7, 1942)	95
Dental examinations and treatments	4,331
Dental plates, splints, and other devices made	415
Physical examinations by Medical Examining Board	357

Beginning in August 1942, and continuing at intervals during the next 8 months, the *Solace* performed the functions of an *evacuating vessel*. Patients were picked up by her at advanced bases to which they had been brought from the battle areas by plane or by fast ships, and were taken to base hospitals farther to the rear. Certain details of this work may not be disclosed for military reasons. In general, the choice of a port for evacuation depended on the number of beds there available and on the urgency of the need for our return to evacuate the advanced bases, since, until mid-November ours was the only vessel so functioning in the area. The better facilities happened to be in the more remote areas; better in regard to climate, equipment and availability of suitable further evacuation facilities to the United States. Our trips were therefore varied both as to duration and destination. In those 8 months the *Solace* steamed over 50,000 miles and evacuated 7,445 patients.

During the latter part of this time, other ships, designated as ambulance ships, also assisted in the evacuation of patients. These were combatant ships that in addition to their naval functions were equipped and manned so as to carry and care for patients on their return trips. As combatant ships they of course had no immunity under the terms of the Hague Convention and their naval function was therefore likely to compete with, or take precedence over, the medical function. When asked about this point, a medical officer on such a vessel said he could

best illustrate it by the story of the troupe of actors that found themselves destitute and stranded on the banks of the Erie Canal and begged a ride to New York on a canal barge. The skipper agreed if they didn't mind riding with his cargo of horse manure. The evening they came to a canal lock. The lock keeper halted. "What barge is that?" The skipper replied, "The Mary Ann." "What is your cargo?" "Horse manure and actors." In the course of the night the same dialogue took place at a succession of locks. Finally, as they approached another lock, an actor tugged at the skipper's sleeve and said, "This time, would you mind giving us top billing?"

While the *Solace* acted as an evacuation vessel, her function was by no means comparable simply to that of a transport or an ambulance ship. Thanks to the excellence of her equipment and the size and training of her medical personnel, she was able at all times to function as a hospital. Patients were not merely transported from one medical facility to another, but were admitted as patients, were studied according to accepted hospital standards, and were given whatever definitive treatment was indicated. The extent to which these functions of a hospital were carried out will be evident throughout the discussion of our medical experiences which is to follow. It is clearly implied in the fact that while we evacuated 7,445 patients, our records show that the diagnosis was established or changed in 552 of them.

In her wanderings, especially at the advanced bases, the *Solace* was frequently in company with other ships and shore stations whose medical facilities were in need of medical supplies. Our ample stores made it possible for this ship to meet those needs and so to serve as a floating and *mobile medical supply depot*. The items most frequently called for included plasma units, Vacoliter units for the intravenous administration of saline, dextrose, and Ringer's solutions, sulfonamide drugs, antimalarial drugs, morphine syrettes, diphtheria, tetanus, and gas gangrene antitoxin, paregoric, multiple-vitamin tablets, plain gauze, gauze bandages, cotton elastic bandages, plaster of paris bandages, and crinoline.

Technicians in the Hospital Corps are ordinarily trained and certified in naval hospitals and medical supply depots ashore. However, the greater the distance of naval units from such facilities, the more difficult it becomes to get technicians as promptly as needed. Our diversified personnel and equipment, combined with the large clinical material on board, made it possible to train technicians and more recently to certify them, not only for our own activities, but for transfer to other ships and stations in the area. *Training and certification of technicians* have covered these fields: Laboratory work, roentgenology, physiotherapy, general dental technique, operating room technique, and property and accounting procedure.

THE USE OF TANTALUM IN TENDON RECONSTRUCTION OF THE HAND

REUBEN C. PEARLMAN

Lieutenant Commander (MC) U. S. N. R.

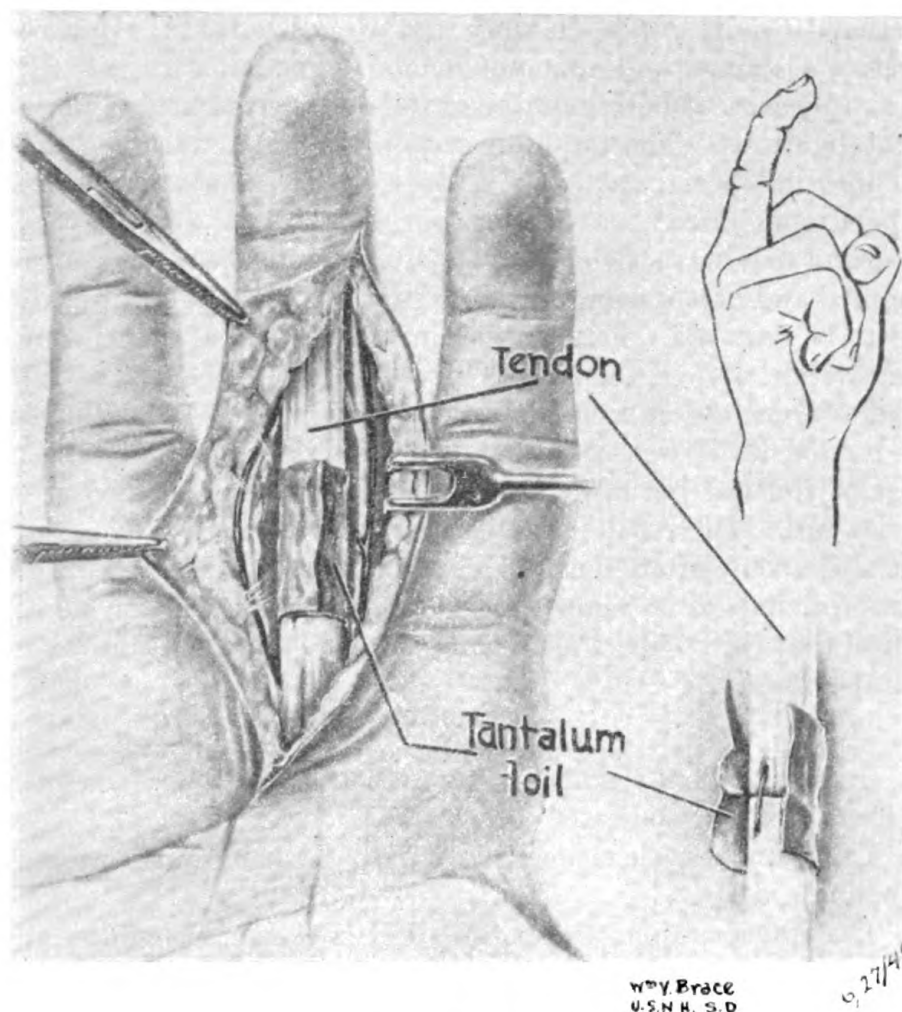
It is such a simple matter, in the loss of function of a finger due to adherent tendons, to amputate the offending member; the wound heals in a very few days, and the patient marvels at the miracles of modern surgery. The patient may not complain if his trade or profession does not require complicated finger and hand movements. But if confronted with the possibility of losing two or more fingers, then he starts to ask questions and lots of them. If the amputation is deferred, is it because of the patient's antagonism, or is it for satisfying one's own conscience? All agree that not one phalanx should be amputated unnecessarily, and those of us who have been specializing in acute and chronic disabilities of the hand for many years realize that the work is not easy. The surgeon treats the injured hand to the best of his ability. Many an excellent job of tendon reconstruction has been performed only to find, in the end, that there has been little or no improvement in the function of that finger, the main reason being adherence of the tendons and their surrounding tissues. It is very depressing after spending 3 hours on a tendon reconstruction on one finger to find the final result often being failure. If only some substance that would prevent adherence could be interposed. Autografts of various tissues of the body have been used for this purpose, with varying degrees of success, for the interposed living tissues usually become fibrotic themselves and adhere. If only there were something, living or nonliving, that would not itself adhere, or on removal would not permit adhesions to form. Aside from the fibrosis and adhesion due to the accident itself, surgery often contributes to further adherence of the tendons and their contiguous tissues. The compactness of the tissues in the finger and the close-fitting skin, in the presence of edema contribute to further scar-tissue formation. In tendon reconstruction, active and passive motion are demanded within a few days following surgery, to reduce the inevitableness of permanent immobility. To keep the swelling at a minimum the following criteria must be observed: (a) Traumatize the tissues as little as

possible; (b) there must be no constrictive tissue; and (c) the proper application of a pressure dressing.

To permanently prevent adherence and obtain freely functioning tendon, I report in this article my personal experiences in the use of tantalum as an interpositional substance. Various metals and alloys have been buried in the tissues of the body by surgeons for the past 3 or 4 hundred years. The precious metals were the first to be used. Petronius (1565) devised a gold plate for defects of the palate. Lapeyade and Sicre (1775) were the first to place metal wire about a fracture. Kearney Rodgers of New York (1897) used his silvered steel screws in fractures. The orthopedic surgeons were among the earliest to use buried metals in the form of wire, screws, and plates. The neurosurgeons of recent years have made much use of buried metals and alloys for covering defects in the skull, as ligatures for hemostasis, and encasement of nerve stumps. Almost all metals and alloys known at that level of a century, were tried by surgeons and then cast aside. Though at first giving promise of success, they later proved just the opposite. The wounds refused to heal; a sinus formed; infected and sterile abscesses resulted; the metal sloughed out; the metal disintegrated before the desired result was obtained. Pancoast in 1844 advised: "Wire sutures should not be used in fractures as they cause necrosis." Their explanation of these poor results was the "natural toxicity of the metal" or "unfavorable reaction." Recently the explanation given for the bad results obtained was that the metal and alloys themselves were toxic to the body fluids; that they became corroded or oxidized with tissue juices resulting in disintegration of the metal. All may be summed up to "foreign body reaction". Today the resistance of the body tissues and fluids to alloys is attributed to the galvanic current generated between one or more constituent metals composing the alloy. For a metal or an alloy to be satisfactory in the presence of tissue fluids, it must be "inert" physically and chemically. After fulfilling this basic requirement, further physical characteristics the metal or alloy should possess are: Ductility, malleability, that it can be "cold-rolled" and its ability to be tempered to various degrees of hardness. It was not until 1936 that a "metal-like" material was produced that fulfilled any of these requirements. That was vitallium, an alloy of the following consistency: Cobalt 65 percent, chromium 30 percent, molybdenum 5 percent.

Vitallium possesses only one of the chemico-physical properties listed, "inertness" in the presence of the body fluids. Screws, nails and plates of this alloy are in use, especially in bone work, but all have to be cast. It cannot be drawn into wire or shaped with a hammer at the operating table. Since the stainless steels vary so much in composition, they all, so far, irritate the tissues, and their use is limited

almost entirely to sutures. At present, there is only one metal-like substance that possesses four of the necessary chemico-physical properties. It is tantalum.



Use of tantalum foil in reconstructive surgery of hand.

Tantalum is a basic element discovered by Ekeberg of Sweden in 1802. It possesses the following properties: (1) Inertness, (2) malleability, (3) ductility, (4) it can be cold-rolled. It can be purchased as sutures, ribbon, foil, plates, and screws. Laboratory studies show that there is no inflammatory reaction when tantalum is buried in the tissues. It appears totally inert. The tissues in contact show no tendency of disintegration and the tantalum appliance does not loosen or cause a foreign-body reaction. It handles easily as suture material of various sizes but I would like to see a finer-sized suture and an increase in tensile strength. Tantalum plates, of varying thicknesses, are extensively used in neurosurgery, following bone losses of the

skull, and the foil is used to prevent adherence between the cerebral and meningeal surfaces.

In my reconstructive work I have been using tantalum foil .00025 inch in thickness as an interpositional material. It has improved the functional results of tendon work and often has made it unnecessary to resect a scarred and adherent tendon. Tendon with raw surfaces was simply encased within tantalum foil and the foil held in place with catgut ligatures. The tantalum-wrapped tendon was then dropped back into its normal channel. A pressure dressing was applied and the part immobilized for three or four days. At the end of that time active and passive motions were begun. The pressure dressings were reapplied and no splinting was necessary. The tantalum foil did not need to be removed. Examination of the tendon at the end of four to six weeks, showed the tendon "free" in its channel. The foil was found fragmented and closely adherent in part, to adjacent tissues. The tendon itself was coated with a glistening layer of cells. The gauge of foil was not always available, and I then was forced to use heavier foil. The results with the heavy foil contra-indicate its use, as it slid about, often causing pressure necrosis of the skin, and in addition it had to be removed, making another operation necessary.

I feel that the results I have obtained with tantalum foil justify its continued use.

SUMMARY

1. Injured tendons tend to adhere to their contiguous tissues, becoming fixed and functionless.
2. Tantalum, a basic element, is apparently inert in the presence of the body fluids.
3. The interposition of tantalum foil between the tendon and its contiguous tissues prevents adherence and a functional tendon results.

REFERENCES

1. ALBEE, F. H. and PRESTON, R. L.: New vitallium cup for arthroplasty of hip. J. Internat. Coll. Surgeons 4: 289-293, Aug. 1941.
2. CAMPBELL, W. C. and SPEED, J. S.: Use of vitallium as material for internal fixation of fractures. Ann. Surg. 110: 119-130, July 1939.
3. KEY, J. A.: Stainless steel and vitallium in internal fixation of bone: comparison. Arch. Surg. 43: 615-626, Oct. 1941.
4. VENABLE, C. S. and STUCK, W. G.: General consideration of metals for buried appliances in surgery. Internat. Abstr. Surg. 76: 297-304, 1943; in Surg., Gynec. & Obst. Apr. 1943.

REDUNDANT DUODENUM

A Radiographic Study

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The superior portion of the duodenum is usually a short segment which proceeds posteriorly and to the right to form the first part of the normal horseshoe-shaped duodenum. Occasionally there is elongation of this segment. In these cases a U-shaped redundancy of the segment distal to the bulb is often seen radiographically. This atypical course may be associated with the deceptive changes in the appearance of the cap. The term redundant duodenum has been used to describe this condition. The variant received scant attention in the roentgenological literature until the late twenties when several continental authors published case reports. In 1933, Feldman (6) in this country reported 12 cases. Since his study, there have been few new reports of the condition in the American literature. The anomaly is briefly mentioned in some of the standard texts on gastro-enterology (1) (5) (10) (11). Despite its frequent occurrence it is apparently unfamiliar to some men. In our experience, failure to recognize the anomaly as such has resulted in erroneous diagnosis. Case 1 was evacuated from a combat area with a diagnosis of duodenal ulcer. Another patient was reported as having pseudo-diverticulum formation of the duodenal cap suggestive of ulcer. Of those reports which we consider to be in error, there was none in which mention was made of this anomaly. It is evident that understanding of the redundant duodenum is necessary for proper evaluation of pathological changes in the duodenal bulb.

Feldman (6) in his series of 500 cases found an incidence of redundant duodenum of 2.4 percent. The figure, 2 percent, is suggested by Bockus (1). We have reviewed a series of 1,000 consecutive gastrointestinal examinations at a naval hospital and have noted 22 cases. This incidence of 2.2 percent in this series is possibly somewhat high because of cases referred to us in error.

CASE REPORTS

Case 1.—A 33-year-old boatswain's mate with 8 years of naval service was admitted at an advanced base complaining of epigastric pain of 1 year's duration. The pain was never incapacitating and usually appeared with hunger. While relieved by food it was often noted after a heavy meal. The patient also complained of equally severe right lower quadrant pain on exertion. Physical examination was essentially negative. X-ray examination was said to show a deformity of the duodenal bulb and the diagnosis of duodenal ulcer was made. He was returned to a base hospital where the same diagnosis was made again. Then he was given 6 months of shore duty after which he was re-examined. Our examination showed an essentially normal cap with a redundant segment of the superior duodenum into which the barium spilled rapidly. There was no significant delay in the loop. The bulb itself was neither tender, irritable, nor deformed. A diagnosis of congenital anomaly was made. A review of his previous studies showed that this was the sole abnormality present, and that what had previously been called a duodenal ulcer represented no more than an example of the distortion of the duodenal bulb often seen with the redundant duodenum (figs. 1A and 1B).

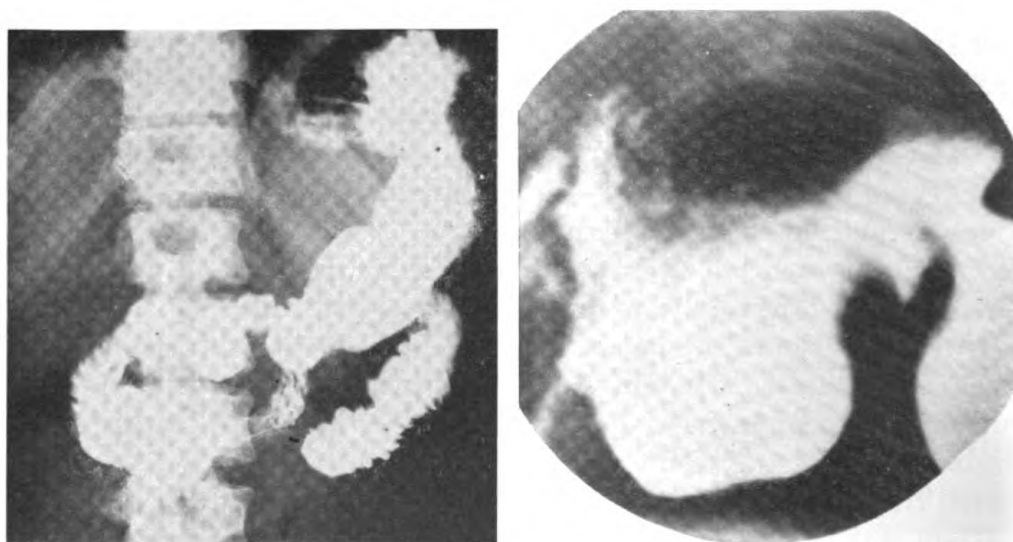


FIGURE 1.—A and B (Case 1.) Normal duodenal bulb spilling into water-trap type deformity of redundant duodenum.

Case 2.—A 4-year-old seaman, first class, with a year and a half of naval service was admitted complaining of epigastric pain 2 to 3 hours after meals, relieved by food. He had frequent night pains. Physical examination and laboratory data were normal. X-ray examination showed a constant deformity of the duodenal cap. The cap was tender and spilled rapidly into a U-shaped superior duodenum. Diagnosis of duodenal ulcer with congenital anomaly of the superior duodenum was made (fig. 2).

Case 3.—A 23-year-old coxswain with 3 years of naval service was admitted with catarrhal jaundice which responded in the usual manner to conservative

therapy. Stool examination showed the presence of hookworm ova. In the course of a gastro-intestinal examination, he was found to have a redundant duodenum. His past history included some attacks of postprandial pain of several months' duration, but no definite story suggestive of duodenal ulcer. There were no pertinent physical findings.

Case 4.—A 39-year-old storekeeper was admitted complaining of pulling left lower quadrant pain and constipation. X-ray examination revealed a U-shaped superior duodenum (fig. 3) and malrotation of the colon. A colopexy was performed and at operation,

malrotation of the colon was found, with the entire large intestine lying on the left side. The greater omental attachment along the greater curvature of the stomach extended 4 cm. beyond the pylorus on the duodenum. This portion of the superior duodenum was directed downward and posteriorly and gave the impression of being pulled down by the omentum.



FIGURE 2.—(Case 2.) Deformed duodenal bulb with U-shaped redundancy of the superior duodenum.

ROENTGENOLOGICAL FINDINGS

With elongation of the segment immediately distal to the duodenal bulb a U or V-shaped redundancy was noted in the superior duodenum.

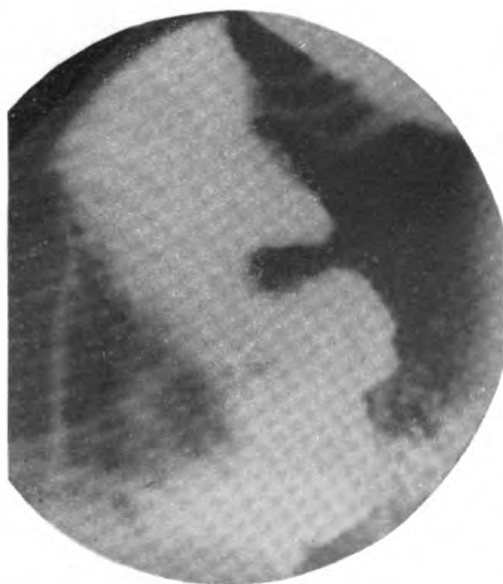


FIGURE 3.—(Case 4.) Normal duodenal bulb with U-shaped deformity of redundant duodenum.

In most of the cases we have studied, this segment has been mobile. The V-shaped tract shows no dilation and usually has an entirely normal mucosal pattern. The U-shaped loop, however, is dilated and usually presents a water-trap appearance. This segment often seems to retain the barium for a short interval in its relatively wide channel. This gives the appearance of "puddling" that has been described. Puddling in a redundancy is not to be confused with retention for the water-trap effect in a redundant duodenum is a transient affair. We have not seen prolonged retention or even significant de-

lay in the emptying time of this segment. Such delay as did occur was not obstructive and probably not even a cause for stasis. In our cases the barium meal passed normally through the duodenum and in no case did we see an empty stomach associated with anything but an empty superior duodenum.

Chronic duodenal obstruction may be associated with dilatation and elongation of the superior duodenum. In these cases, a U-shaped redundancy has been noted. This should be differentiated by its obstructive concomitants—gastric retention and failure of normal progress of the meal into the jejunum.

Elongation of the superior duodenum may be associated with changes in the bulb that simulate the changes seen in peptic ulcer. One of the disturbing features of the lesion is the rapidity with which a partially filled duodenal cap spills into the descending loop of the redundancy. This is not to be confused with irritability or deformity with failure or filling. In the erect position, flattening or peaking at the cap may occur because of the traction of the mobile U-shaped loop. At the angle formed by the bulb and the descending limb of the redundancy, the mucosal folds overlap and interlace. A stellate mucosal pattern at this point may be analogous to the stellate formation often seen at the superior angle of the normal duodenum. In the case of the redundant duodenum, this shadow may occur close to the pylorus and is likely to be interpreted as a crater or scar. A large, flaccid bulb often has much the appearance of a redundancy of the superior duodenum. Careful observation of the progress of the barium should settle this problem.

In each case careful scrutiny of the bulb itself must be made so that the apparent deformity and irritability associated with redundancy of the superior duodenum will not be confused with intrinsic duodenal pathology.

ANATOMY

As a result of the rotation of the mid-gut about the axis of the superior mesenteric artery, the normal duodenum assumes its usual horseshoe-shaped curve. The duodenal cap, which represents the pars superior, passes posteriorly and to the right behind the liver to form the superior angle with the pars descendens in the region of the gallbladder. The usual length of the superior segment is from 3.7 to 5.0 cm. according to Cunningham (4). Its peritoneal relations are similar to those of the pyloric end of the stomach for about the first inch in which it is invested by peritoneum on the right and left aspects. From its superior border, the peritoneum is reflected as the hepatoduodenal ligament and from its inferior border as a band known as the right gastro-pancreatic fold which passes to the left onto the pancreas and posterior abdominal wall. As it proceeds distally

and farther posteriorly, the duodenum loses the peritoneum on its dorsal surface. The descending duodenum is retro-peritoneal, being covered by peritoneum only on its anterior surface. The first portion of the duodenum is thus partially intraperitoneal and relatively mobile. It is more or less fixed by the hepatoduodenal and gastropancreatic folds. Near the superior angle, the duodenum becomes immobilized by virtue of its retroperitoneal position. In addition there is further fixation at the point where the transverse colon or mesocolon crosses the mid-portion of the descending duodenum.

According to Hunter (11), the duodenum owes its adult position to three factors acting on the developing gut segment: (a) A series of differential growth changes which lead to the formation of the two loops in the primitive straight duodenum; (b) the position of these loops is governed by changes which take place in neighboring organs; and (c) disappearance of the mesentery after the duodenum and colon have assumed their adult relations to the posterior abdominal wall. Abnormally rapid growth of the first portion of the duodenum would result in redundancy of the segment between the pylorus and the superior end. Similarly, distortion of the colic fixation may result in an unusual course of the closely related duodenum. A third mechanism of abnormality would be a change in the normal absorption of the dorsal mesentery.

In the explanation for redundant duodenum as given by Feldman (6), in 1933, the anomaly is described as the result of the unusual length of the segment distal to the cap and abnormal fixation of the superior angle by a hepato-duodeno-colic band. These cases might occasionally be associated with obstruction, but we feel that a simpler mechanism accounts for a large group of these cases. We are inclined to agree with a more recent (7) suggestion that the redundant duodenum is often merely a special variant of the mobile duodenum in which there is incomplete resorption of the dorsal mesentery. Thus, several inches, instead of the proximal one inch, remain peritonealized. In place of a 3-cm. segment suspended between two short peritoneal bands, there is a U-shaped loop following the same course but suspended by longer folds to retain the appearance and character of the mesentery. This accounts for the mobile 10- or 15-cm. segment which, by way of a U-shaped loop, proceeds posteriorly and to the right of the superior angle.

In a certain number of cases thickening of the margin of the hepatoduodenal ligament results in transduodenal bands. Harris (10) has described hepato-duodeno-colic bands which cross the duodenum. In some cases, these ligaments are the basis for chronic duodenal obstruction which is often characterized by dilatation and elongation of the superior duodenum (9).

Feldman (7) has suggested that the redundant loop might lead to a certain amount of stasis which could produce symptoms *per se* or result in inflammation with ulceration. Bockus is of the opinion that the abnormality is of little intrinsic clinical import. Templeton (12) discards the whole matter in a few words stating that the lesion is of no clinical significance.

Anatomically, the redundant duodenum is a free, intraperitoneal loop of small intestine analogous to jejunum, or ileum. Since no fixed angulation of unusual tortuosity suggests a point of obstruction, it would be unlikely that any significant delay in passage through this loop would occur. "Puddling," described on occasional films, is transient. In each case, the meal passed normally through the water-trap deformity. Serial films showed no contrast media in the duodenum after the stomach was empty. Although chronic duodenal obstruction in a U-shaped loop has been observed in cases with transduodenal bands, we have not seen any such cases. Since we did not observe abnormal progress of the meal, we did not feel justified in ascribing clinical symptoms to the variant.

Attempts to analyze the data clinically were not fruitful. The symptoms in the different patients were varied and we were unable to detect any striking similarities. In many cases gastro-intestinal series were undertaken merely as a means of ruling out organic disease in patients complaining of vague pain. The only symptom mentioned with considerable frequency was a sense of discomfort after meals. With this we were not impressed. Feldman (6), who feels that a redundant duodenum may cause symptoms, states that it is impossible to predict the lesion on clinical evidence.

A statistical approach is not entirely valid when there is no large group of normal controls. We have compared the number of cases with demonstrable lesions in the stomach or duodenum in the total series of 1,000 patients with the number of lesions in the group with redundant duodenum. Of the entire group, there were 248 patients who had definite pathology in the stomach or duodenum. This includes ulcers and carcinomas but not gastritis or duodenitis. Six of the twenty-two patients with elongation of the superior duodenum show evidence of defect in the stomach or duodenum. Since the figures in each group approximate 25 percent, we feel justified in suggesting that the redundant duodenum is not a contributive factor to either gastro-intestinal pathology or symptomatology.

CONCLUSIONS

1. Attention is again called to the presence of elongation of the segment immediately distal to the duodenal bulb, a common entity

which should not be confused with deformity of the cap associated with intrinsic disease.

2. The anatomy and roentgenological findings are described.

3. We have given evidence for our belief that the lesion causes neither symptoms nor additional pathology.

REFERENCES

1. BRYCE, T. H.: Unusual anomaly of duodenum. *Proc. Anat. Soc. Great Britain & Ireland*, 1899.
2. BOCKUS, H. L., et al.: *Gastro-Enterology*. W. B. Saunders Co., Philadelphia, 1944.
3. BRYANT, J.: Visceral adhesions and bands: normal incidence. *Am. J. M. Sc.* 165: 111-120, January 1923.
4. CUNNINGHAM, D. J.: *Text-Book of Anatomy*. 6th edition, revised. William Wood & Co., Baltimore, Md., 1931.
5. DUVAL, P., ROUX, J. C., and BÉCLÈRE, H.: *Duodenum; Medical, Radiologic, and Surgical Studies*. Translated by E. P. Quain. C. V. Mosby Co., St. Louis, Mo., 1928. p. 20.
6. FELDMAN, M.: Redundant duodenum. *Am. J. M. Sc.* 186: 198-202, August 1933.
7. FELDMAN, M.: *Clinical Roentgenology of the Digestive Tract*. 2d edition. Williams & Wilkins Co., Baltimore, Md., 1945.
8. GEIGY, C. F.: Beitrag zur Klinik und Therapie des Duodenum mobile. *Helvet. med. acta.* 10: 303-307, June 1943.
9. GOLDEN, R.: Chronic duodenal obstruction. *New York State J. Med.* 33: 819-824, July 1, 1933.
10. HARRIS, M. L.: Constrictions of duodenum due to abnormal folds of anterior mesogastrium. *J. A. M. A.* 62: 1211-1215, April 18, 1914.
11. HUNTER, R. H.: Development of duodenum. *J. Anat.* 61: 206-212, January 1927.
12. TEMPLETON, F. E.: *X-ray examination of stomach*. University of Chicago Press, Chicago, 1944.



PHOSPHORUS METABOLISM OF PRESCHOOL CHILDREN

The phosphorus metabolism of eight preschool children was studied over an experimental period of 20 weeks. Five variations of the diet were used: basal diet alone, basal diet plus 100 mg. ascorbic acid, basal diet plus 3.38 grams potassium citrate with and without the ascorbic acid supplement, and basal diet plus orange juice. The phosphorus intakes ranged from 896 to 1,374 mg./day. The average phosphorus retentions varied from 3.5 to 10.8 mg./kg. None of the supplements caused significant alterations in the retentions although rather wide variations occurred from period to period. This might indicate that other factors than diet are largely responsible for fluctuations in phosphorus retentions.—McKEY, B. V., CLARK, M. F., MEYER, F. L., and HATHAWAY, M. L.: Phosphorus metabolism of preschool children. *J. Nutrition* 31: June 1946.

PROCTOLOGY IN THE U. S. NAVAL HOSPITAL

An Analytical Review of a 6-Month Period¹

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A review of the work done in a ward devoted almost entirely to proctology at the United States Naval Hospital, Chelsea, Mass., shows the need for such departments in our naval hospitals. In a period of 6 months at Chelsea, 18.4 percent of the general surgery was proctologic surgery, 14.5 percent being done by the proctologic ward and 3.9 percent by other wards. In this same 6-month period, there were 431 proctosigmoidoscopic examinations. It is the purpose of this paper to show how these cases were diagnosed and evaluated, and in general, how handled.

THE NEED FOR A PROPERLY ORGANIZED AND EQUIPPED PROCTOLOGIC WARD

It is evident that a properly organized ward, devoted to proctology, requires specialized instruments and equipment. A detailed list is here omitted. Such instruments and equipment vary according to personal choice and experience, and their choice is dependent upon individual and local needs. Suffice it to say, any well-trained proctologist can easily supply those facts. Proper instruments, in proper hands, are naturally a requisite. A good diagnosis requires this, and treatment demands it. This does not mean necessarily that only a proctologist can fill the bill. Naturally, the well-trained proctologist could. However, many conditions the proctologist treats are in the realm of general surgery, and are adequately cared for by the surgeon. But unless a correct diagnosis is arrived at, proctologist, surgeon, and patient are at a loss. A large number of rectal and sigmoidal lesions depend entirely upon a proctosigmoidoscopic examination for diagnosis, and all require a careful history and a physical examination, with an exacting rectal and an anal examination. Not infrequently,

¹ Review covers work from 17 April 1945 to 18 October 1945.

with such additional examinations, colon x-rays, stool examinations, and other laboratory findings are necessary. All cases should be proctosigmoidoscoped, and all cases should have the anoscope inserted and the anorectal region carefully probed and inspected. Unless this is done, many adenomas will be missed, hemorrhoids may be needlessly operated, conditions may be improperly evaluated and other errors committed, possibly grave in consequence. The review of cases to be presented will bear this out, for it is only too apparent that many diagnoses arrived at could only be by reason of careful methods, and an experienced operator.

THE PREPARATION OF THE PATIENT FOR EXAMINATION

The proctologic ward in the naval hospital, as is true with other specialty wards, must meet the needs of outlying medical activities and ships at anchor. Many cases from outside the hospital, as well as from other wards within the hospital, were seen for consultation and for treatment. Therefore, it was necessary in the organization of this ward to notify all wards and nearby activities that preliminary preparation of the patient prior to examination was desired. Routinely, two-quart cleansing enemas of hot water were given, one early in the morning and the other, 2 or 3 hours following, the latter if possible, about 2 hours before examination. If the returns were inadequate, it was requested that the procedure be repeated. Quite a few patients from outside points would come unprepared, however, because of conditions not permitting preparation. Examination in such cases was always done, regardless, since with care an adequate sigmoidoscopic and proctoscopic examination many times was possible, especially if bowel evacuation had occurred recently. Some, of course, required reexamination.

THE PREOPERATIVE PREPARATION OF THE PATIENT

A routine preoperative preparation was necessary because of the large volume of cases operated, and a crowded ward and hospital necessitating a rapid turn-over. Proper preoperative preparation of proctologic cases aids materially in better surgery, and lessens the possibility of postoperative complications. It likewise permits a smoother-running ward, and in the ward avoids confusion. Since 285 patients were operated in this 6-month period, this seems the more obvious. Forty-four and five-tenths percent of these cases were pilonidal sinuses, and the remaining 55.4 percent proctologic cases of many types.

Since the pilonidal sinuses were in all cases excision and closed operative procedures, their exceptionally careful preoperative prep-

arations were necessary, and much depended on it. A detailed description of the pre- and post-operative management of these cases, together with a description as a combined method of management and new operative procedure, appears in papers published elsewhere. In brief, the salient points concerned in the preoperative management of the pilonidal sinus when operative excision and closure is scheduled, consists in :

1. Thorough emptying of the colon with four repeated, quart, warm to hot water enemas, with 2 ounces of mineral oil per enema preceding. Three are given the afternoon and evening of the day preceding surgery, and one early in the morning of the day of surgery.
2. Thorough scrubbing and cleansing of the patient, and careful sterile preoperative preparation of the field for surgery. The patient is shaved over a wide expanse over perineum, pubis, and lower back.
3. Light supper is given the night before surgery.
4. Pentobarbital sodium is given immediately preoperatively.
5. No food or water is given from midnight preceding surgery.

The rectal case is similarly prepared, excepting that such preoperative scrubbing and shaving is unnecessary; the perianal and the anal region alone is shaved, and the anus is not prepared sterily preoperatively.

THE POSTOPERATIVE CARE OF THE PATIENT

The pilonidal sinus operative group was treated postoperatively by a planned method, to prevent bowel movement for 10 days or longer. This was aided preoperatively by the repeated enemas, and postoperatively by a liquid diet, paregoric, 1 dram three times daily, and continued bed rest. Morphine was given postoperatively on the day of surgery. Penicillin and sulfonamide therapy was followed postoperatively 8 to 10 days respectively.

The postoperative care of the anorectal operation consisted in measures to relieve pain, and promote rapid healing. Bowel action usually did not occur until the fourth postoperative day and was aided by a routine oil-retention enema the night before, and when necessary, induced with a half pint, or pint, water enema on the fourth postoperative day. The rectal dressing, consisting of a cigarette drain and iodoform gauze, was removed 48 hours following surgery. Daily postoperative treatments were given by the physician following this first treatment. A cotton dressing was inserted in the creases and surface of the anal wound and changed every 2 hours daily, until complete healing had occurred. Daily hot sitz baths and hot wet packs, applied for 3 hours, were routine for 1 week following surgery. Likewise, irrigations of a few ounces of hot water were given following every bowel movement, until healing was complete. This was done with catheter and syringe. All the patients were instructed in

doing this themselves and the work in the ward was lightened considerably by their self-administered irrigations, commencing 5 to 7 days postoperatively. Patients in most instances were allowed up the day following surgery, and were permitted a soft diet as soon as tolerated. Mineral oil in teaspoonful doses was given twice daily for 5 days postoperatively.

Mimeographed copies of the pre- and post-operative care were given all hospital corpsmen, nurses, and internes. This detailed all preoperative and all postoperative treatment day by day to the eighth postoperative day, when sitz baths and hot packs were usually discontinued and full diet permitted. Included in the mimeographs was a description of the way to properly administer an enema in the lateral Sims or knee chest position, and how a proper massive, hot, wet pack is applied to postoperative rectal cases.

The patient was also given a mimeographed sheet, which explained in simple English what was done, why it was done, and what he himself was expected to do. A better satisfied and more cooperative patient was thereby obtained.

Undoubtedly these methods aided considerably in preventing postoperative complications, there being only 16.9 percent in the pilonidal group, mainly minor, and 2.5 percent in the rectal group. Complications in both groups were corrected with dispatch.

THE SELECTION OF CASES FOR TREATMENT AND SURGERY

No case can be properly treated unless a proper diagnosis is made, and no diagnosis can be arrived at without benefit of a patient properly prepared for examination. It is necessary, in addition, to evaluate the condition or disease correctly, if proper treatment or good surgery is to be given. The decision as to what course of treatment is necessary and if, in fact, any is actually necessary, requires good judgment and experience. To simply offer a diagnosis alone does not suffice. More properly a "working diagnosis," as the wording implies, provides a tangible answer. Hemorrhoids, though present, should be disregarded when a working diagnosis of adenocarcinoma is made. Likewise, hemorrhoids when evaluated as slight or moderate, are many times amenable to injection treatment, whereas severe hemorrhoids are not. An adenoma, as a rule, cannot be diagnosed without benefit of proctosigmoidoscopy, is recognized as being potentially malignant, and should always be destroyed. Perianal or rectal abscesses likewise are correctly treated after drainage when a working diagnosis of fistula is correctly made.

Circumstances surrounding a case play a great part in the handling of deliberate surgery, particularly, when the surgery is proctologic.

The history is extremely important in helping to evaluate what treatment or whether treatment is necessary. A moderate degree of hemorrhoids, for example, may or may not be giving a great deal of trouble. A patient may be a very necessary party aboard a ship. The time for surgery, when surgery is eventually necessary, may or may not be when the patient already is confined in the ward. For the good of the Navy, conclusions arrived at must many times be along such lines of reasoning. Each case, therefore, should be thought of individually, and advice and treatment given accordingly. Treatment, too, must vary with the facilities at hand, and the time permissible. In the naval hospital the most expeditious treatment generally is the most desirable, since a limited period of time and a crowded service prevents much ambulatory work and therefore, surgery when indicated, most often should be the method of choice.

Analyzing the results of examination and surgery help to demonstrate how a working diagnosis was arrived at and the disposition of that case properly evaluated.

A REVIEW AND ANALYSIS OF THE 431 PROCTOSIGMOIDOSCOPIC EXAMINATIONS

As stated, these cases are the total number examined during the 6-month period. Table 1 shows that of the cases proctosigmoidoscoped 99 or 23 percent were essentially negative. The remaining 77 percent showed the greater number of hemorrhoids. This group was slightly over one-third or 35 percent and was present as a primary or secondary associated finding in 191 or 44 percent of the cases examined. Fissure was next in occurrence, being 28 cases or 6.5 percent, pruritus 5.5 percent, adenoma 4.8 percent, fistula in ano 4.4 percent, anal abrasion 4.18 percent, abscess 2 percent, primary sinus 1.3 percent and primary and secondary accompanying sinus 2.5 percent. All other conditions were 1 percent or less.

TABLE 1.—*Essential or "working diagnoses" in 431 proctosigmoidoscopic examinations*

	"Working diagnosis"	Additional cases of secondary diagnosis	Total
Negative.....	99		99
Hemorrhoids.....	160	31	191
Anal abrasion.....	18		18
Anal fissure.....	28		28
Pruritus.....	24		24
Anal condyloma.....	5		5
Prolapsing papillae.....	4	4	8
Anal sinus.....	6	5	11
Abscess.....	5	4	9
Fistula in ano.....	19		19
Fistula, rectovesical.....	1		1
Rectal prolapse.....	1		1
Adenoma.....	21		21
Adenocarcinoma, rectum.....	1		1

TABLE 1.—*Essential or "working diagnoses" in 431 proctosigmoidoscopic examinations—Continued*

	"Working diagnosis"	Additional cases of secondary diagnosis	Total
Dermal sinus, anorectal.....	1		1
Rectal stricture.....	3	1	4
Amebic ulceration, rectosigmoid, rectum.....	5		5
Suspected amebiasis with colitis.....	9		9
Unhealed p. o. sinus with regional ileitis.....	1		1
Ulcerative colitis.....	5		5
Colitis with scattered mucosal petechiae.....	1		1
Colitis, unknown type.....	1		1
Mega-rectum and sigmoid.....	1		1
Colitis with suspected hookworm.....	1		1
Lymphopathia venereum.....	1		1
Leukemic infiltration, rectum and sigmoid.....	1		1
Perianal inflammation.....	1		1
Perianal fibroma.....	1		1
Sacral area lesion.....	1		1
Lipoma, buttocks.....	1		1
Suspected carcinoma, colon.....	1		1
Probable carcinoma, colon.....	1		1
Coloscopic examinations.....	2		2
Traumatic lesion, rectosigmoid (inserted pencil).....	1		1
Total.....	431	45	476

HEMORRHOIDS

In the hemorrhoidal group surgery was strongly advised in 62, was advised if desired in 43, was advised in 9 additional, and found unnecessary in 23. (See table 2.) The factors determining the advisability of a hemorrhoidal operation where moderate hemorrhoids are present, depend a great deal upon the history and symptoms, as well as upon the personal factors surrounding the case. A case not included in this series with only slight to moderate hemorrhoids, needed operation badly because of long-continued rectal bleeding and a resultant red blood count of 2,170,000, with a 46 percent hemoglobin. On the other hand, one patient seen had a severe permanent prolapse of 20 years' standing, was tolerably comfortable, and could yet have had surgery postponed, if his active services were urgently needed.

In the examination it must be remembered that hemorrhoids are collapsible, that anoscopic dilatation facilitates their proper exposure, and straining may demonstrate a prolapse, otherwise unrecognized. A system of grading the degree of internal and external groups, as well as their location, is important. In this series, grading was done on a basis of IV, grade I being slight or of no clinical significance, and grade IV very severe.

No patient should be operated upon unless symptoms are repeatedly present and are definitely due to hemorrhoids. Associated conditions, such as fissure, adenomata, fistulae, or prolapse, may require at the time of surgery that hemorrhoidectomy likewise be performed. All but 4 of 31 such cases required surgery. Such cases naturally influence the decision favoring surgery.

The uncomplicated hemorrhoids of moderate degree may be selected for injection treatment. This type of ambulatory treatment is not well adapted to the majority of naval personnel, because treatment checkup usually requires several weeks to best assure that adequate treatment has been given.

TABLE 2.—*Evaluation of hemorrhoidal cases when examined*

	Number	Surgery advised	Injection treatment	Operation unnecessary	Local ex- cision
Marked or severe.....	19	19			
Prolapsing.....	31	31			
Marked with thromboses.....	12	12			
Moderate or slight.....	73	43	23	7	
Simple thromboses.....	16			16	11
Not graded.....	9	9			
Total.....	160	114	23	23	11

Additional cases with associated conditions. Surgery done in 27 of these cases.

Marked or severe hemorrhoids.....	6
Prolapsing.....	5
Slight or moderate.....	20
Total.....	31

ANAL ABRASION

This condition, frequently associated with hemorrhoids of moderate degree, is very apt to be overlooked or misdiagnosed as fissure or hemorrhoids. The importance of its recognition cannot be over-emphasized, since repeated bleeding in the presence of hemorrhoids was seen in many of these cases, and none required surgery.

FISSURE

Fissure in ano, usually posterior, was present anteriorly in 4 of the 28 cases seen, or in 14.2 percent. Its location may be in the mid-anal canal, marginal at the orifice, or close to an offending crypt at the dentate margin. It is not necessarily fissured but may be a punched-out anal ulcer. When near the anal orifice, a large inflammatory tag or "sentinel pile" may overlay it and an infected crypt and hypertrophied papilla may be an accompanying part of a triad of cardinal findings. Sinus accompanied 4 of these cases, and fistula in ano occurred from another three in the series. A definite pruritus was present with another fissure. In pruritus, the superficial fissuring of skin is occasionally misdiagnosed as an anal fissure. Therefore, it is important to remember that true fissures are characterized by chronicity, are usually painful and are definitely ulcerated into or through the anal epithelium.

Though it is realized many fissures are well handled by ambulatory treatment, surgery seems preferable in the naval hospital. All but four cases were advised surgery.

PRURITUS

This condition was seen in 24 cases, all of which were medically managed or advised, except four. Surgery or alcohol injection should be done only when all medical management is exhausted. Itching is not characteristic solely of pruritus ani but the characteristic itching occurs usually at night, is aggravated by heat and perspiration, and like the disease, is chronic in character. Pruritus must be accompanied by skin changes, varying from an early perianal erythema to marked kraurosis or lichenification, to justify the diagnosis.

ANAL AND RECTAL ABSCESS AND FISTULA IN ANO

Anal or rectal abscess occurs usually from a preceding cryptitis or fissure. The abscess may carry above the levator musculature and variously enter the tissue spaces, pelvirectally, perirectally, etc. Otherwise, it may be below the levator musculature to enter the subcutaneous areas or the ischioanal space, known more commonly as ischiorectal fossa. Such a low coursing abscess may carry through under or over the external sphincter. They may be retro-anal, perianal, intra-anal, or perineal. The intra-anal or intra-rectal portion may be simply indurated tissue with no localized pus pocket. This frequently confuses the examiner, who is apt to think in terms of strangulated hemorrhoids. Since on incision and drainage externally such cases thereby become fistula in ano, these cases likewise were mainly fistulae shortly after diagnosis. Seven of the nine cases were such. One of the seven was supralelevator.

The determination of the primary crypt responsible for abscess and fistula formation, requires careful probing through the secondary external fistulous opening, and probing and inspection of the crypt under suspicion. Frequently it appears quite innocent. If the tract leads to it, surgery will later definitely confirm it as the offender.

ADENOMA

Seen in 21 cases, 4 adenomas were multiple, 3 were close to or in the internal hemorrhoidal zone, 5 additional were rectal, and the remaining adenomas, sigmoidal. Five cases had pedunculated adenomas. The adenomas remaining were sessile. One case showed degeneration.

All these adenomas were destroyed, though not all cases were listed on the operative schedule. Ideally, adenomas should be fulgurated when first seen, if they are small and facilities permit. All adenomas should be destroyed as soon as possible, because they are potentially malignant.

ANAL SINUS

These cases, when closed, are virtually incomplete fistulae or the so-called blind, internal fistula. Small intra-anal through and through tracts are difficult to demonstrate, since they may not admit large probes and folds of skin or mucosa may overlies them. Six cases were purely sinus, not accompanied by other pathology of significance. Five cases were those accompanied by fissure, from which they arose. Their recognition and excision is necessary, since, when left, they may inflame or abscess. Abscesses of inflamed pilonidal sinus, furunculosis, and such were frequently seen and treated. They are not included in this review.

OTHER CASES OF INTEREST AND UNUSUAL FINDINGS

Naturally, a paper of this sort can only schematically outline many types of cases and their highlights of importance. To state, however, that in a brief 6-month period the properly organized ward, devoted to proctology, can see and treat or diagnose between 30 and 40 different proctologic conditions probably requires a review of this sort to convince. Such is the case as table 1 demonstrates.

One case listed, true anorectal dermal sinus, is rare. It is being reported in conjunction with another case seen. Amoebic ulceration and those cases with irritated mucosa, highly suggestive of amebiasis, had a high incidence.

THE RESULTS

The operations listed in table 3 are those which were scheduled in the operating room. They were, for the most part, done under spinal anesthesia. They include two groups—one, a group of 127 pilonidal sinus, operated by a new closed procedure, and the other a group of 160 cases corresponding to the cases proctosigmoidoscoped. Since, as previously stated, the first group is being reported in detail in a separate article, and the second group conforms closely to the cases already proctosigmoidoscoped, of which they are an operative part, it is not necessary to analyze them in detail. Four cases of the latter group developed complications, two of which were postoperative hemorrhage following hemorrhoidectomy, one, a postoperative stricture, and the remaining case, a small postoperative retro-anal abscess. These were corrected. All cases were dismissed as healed, as well.

The relatively high percentage of surgery done by the proctologic ward, and a comparison of the type of case and its incidence, are shown in tables 4 and 5.

DISCUSSION

Whereas proctology has always been practiced in the naval hospital, not all naval hospitals, as is true in other hospitals likewise, have had

an organized department devoted to that specialty. The purpose of this article is not only to present methods of management of ward and proctologic cases as could be demonstrated by the review presented but, likewise, to show the rather large numbers of cases seen and treated in such a ward. That such a group could be duplicated by similar departments elsewhere seems self-evident. In addition, it is rational to surmise that a great number of cases would remain undiagnosed and untreated, if such were not the case.

TABLE 3.—*Operations performed*

Operation	Number	Operation	Number
Hemorrhoidectomy.....	79	Spur clamp to colostomy.....	1
Anal condyloma.....	4	Colostomy closure.....	1
Prolapsing papilla.....	3	Fecal fistula.....	1
Anal fissure.....	23	Rectovesical fistula.....	1
Pruritus.....	4	Dermal sinus (anorectal).....	1
Fistulectomy.....	17	Perianal fibroma.....	1
Rectal stricture.....	3	Anal sinus.....	4
Rectal prolapse.....	1		
Adenoma.....	16	Total.....	160

¹ 2 cases are included under 4 headings; therefore, total listed operations equals 158.

TABLE 4.—*Volume and comparison of general surgery and proctologic surgery during 6-month period at U. S. Naval Hospital, Chelsea, Mass.*

	Total surgery	Total proctologic surgery and percentage to total surgery	
	Number	Number	Percent
Proctology ward.....	285	285	14.5
Other wards.....	1,673	77	3.9
All wards.....	1,958	362	18.4

TABLE 5.—*Volume and comparison of pilonidal-sinus surgery and all other types of proctologic surgery during a 6-month period at the U. S. Naval Hospital, Chelsea, Mass.*

	Total proctologic surgery	Pilonidal sinuses operated and percentage to total proctologic surgery		Proctologic cases other than pilonidal sinuses operated and percentage to proctologic surgery	
		Number	Percent	Number	Percent
Proctology ward.....	285	127	44.6	158	55.4
Other wards.....	77	40	51.9	37	48.1
All wards.....	362	167	46.1	195	53.9

Many cases in this series gave examples of previous error committed. One such had had nine fistulectomies performed, the last three being at naval hospitals. Throughout these periods no sigmoidoscopic examination had been made, since a large pedunculated adenoma at

13 cm. was his diagnosis in this series group report. However, we are all subject to error, and it is not the purpose of this paper to criticize, but to offer a constructive program. Proper instruments, a properly prepared patient, a well-organized department, and an experienced operator are the essential requisites.

CONCLUSIONS

1. A review is given of 6 months' work in a ward devoted mainly to proctology at the United States Naval Hospital, Chelsea, Mass.
2. An analysis is made of all cases examined, as well as those operated.
3. General methods of diagnosing and evaluating cases for treatment are given.
4. The organized management of the ward, and the care of patients pre- and post-operatively, is outlined.
5. Essential aids in the diagnosis of various types of proctologic cases are mentioned.
6. The review of the work, and the conclusions drawn, show the need for establishing wards devoted to proctology in our naval hospitals.



THIAMINE, RIBOFLAVIN, NICOTINE ACID, PANTOTHENIC ACID, AND ASCORBIC ACID CONTENT OF RESTAURANT FOODS

Previous studies of vitamins in restaurant foods have indicated that losses during preparation and service are frequently high, particularly in thiamine and ascorbic acid.

The present survey was undertaken to determine the amounts of thiamine, riboflavin, nicotinic acid, pantothenic acid and ascorbic acid which are actually available to the restaurant-going public, and to compare the vitamin content of foods from representative restaurants in each of three price groups. The results indicate that no marked differences existed in the vitamin contents of the foods from the three restaurants. Requirements of riboflavin and nicotinic acid were easily met by varied diets. Adequate thiamine intake was possible with judicious selection of meals, whereas ascorbic acid requirements could be maintained only by the frequent consumption of fresh fruit juices. Other items of the restaurant diets contribute very little to ascorbic acid intake. Complete tables show the amounts of these five vitamins in foods served during a day at each restaurant.—SABETT, H. F., BENNETT, M. J., RIGGS, T. R., and CHELDELIN, V. H.: Thiamine, riboflavin, nicotinic acid, pantothenic acid, and ascorbic acid content of restaurant foods. *J. Nutrition* 31: June 1946.

TSUTSUGAMUSHI DISEASE ON SAMAR, PHILIPPINE ISLANDS

Rats as a Reservoir of the Disease

EPIDEMIOLOGY UNIT NO. 61¹

An excellent discussion of tsutsugamushi disease and a comprehensive review of the literature pertinent thereto has recently been published by Farner and Katsampes (1). Insofar as they could determine from the literature, authentic cases of tsutsugamushi disease have not been reported from the Philippines. The experiences of the armed forces in this area during the first 9 months of 1945 have shown that the disease does occur here. Farner and Katsampes were cognizant of the possibilities when they stated that, "it is safer to anticipate encountering the disease in the Philippines." It is the purpose of this paper to show that the disease is encountered here and to offer some evidence that rats are one of the animal reservoirs.

From 1 January 1945 to 1 October 1945 eighty-one cases of tsutsugamushi disease were admitted to the sick list, according to available records. There was one death from the disease. These cases were diagnosed, both clinically and serologically, as tsutsugamushi disease. Unfortunately a detailed clinical record of each case is not available. However, it is sufficient to say that clinically the cases presented typical clinical signs, objectively and subjectively. The primary skin lesion at the site of the bite of the larval trombiculid mite, with regional adenopathy was found on quite a few cases. Generally, the rash, conjunctival injection, signs of pulmonary involvement, characteristically slow pulse in relation to the temperature, and other symptoms were present. Added to the clinical signs are the serological findings of this laboratory.

It is realized that the demonstration of a gradual increase in the agglutinin titer by repeated examinations of the blood of suspected cases is much more diagnostic than finding a significant titer on a single examination. It was not possible in most cases to obtain

¹ Personnel of Epidemiology Unit No. 61 during the period of this study were: Commander Allison F. Errington (MC) U. S. N. R., officer-in-charge; lieutenant, junior grade, Arthur N. King H(S) U. S. N. R.; ensign Phillip M. Griffith H(S) U. S. N. R.; pharmacist's mates, first class, Paul R. Carter, Martin J. Lynch, Jr., Robert B. Marlatt, Harvey Reisman, Harold R. Schorr, and Raymond A. Van Stee, U. S. N. R.; and pharmacist's mate, third class, Richard B. Rynda, U. S. N. R.

samples of blood from a patient over extended periods. Agglutinins for *Proteus* OXK in a titer of 1:160 or above were found in 81 cases. The distribution by agglutinin titer is shown in the following table:

Titer.....	1:160	1:320	1:640	1:1280	1:2560	1:5120
Number.....	39	14	9	12	6	1

Fifty-four of the eighty-one cases occurred during the period from 8 January 1945 through 8 March 1945, and the occurrence of 66.6 per cent of these cases during this 2-month period may appear to be a "seasonal incidence." However, other factors were present that may account for this. During this period a tremendous amount of construction work was in progress, a considerable portion of which was in wooded, brushy areas, and it naturally follows that great opportunity to come in contact with infected mites was presented. These 54 cases, in addition to presenting clinical signs of the disease, all showed a *Proteus* OXK agglutination titer of 1:160 or above. All the patients were among naval personnel. No cases were reported from the civilian population and no laboratory work was done on the latter group. According to medical intelligence reports and local Filipino doctors, the disease was not present in this area before the Japanese occupation. Since the disease was known to be present among Japanese troops and its vectors and their hosts are present throughout the Philippines, it is theoretically possible that the disease was introduced here by the Japanese.

A detailed clinical study of the cases was not possible because of the lack of centralization of the patients and their early evacuation. The over-all picture of the clinical aspects, however, is given in the four cases briefly summarized.

Case 1.—Patient admitted 6 January 1945.

CC: General malaise, headache, and fever.

PE: Negative except for injected fauces and a maculopapular eruption on the abdomen and legs. On 12 January he had a generalized maculopapular rash. The bronchial sounds were rough and there was a moderate generalized lymphadenopathy.

Serology: Agglutinations with *Proteus* OXK:

8 January 1945: Positive.....	1:20
15 January 1945: Positive.....	1:80
22 January 1945: Positive.....	1:320

Case 2.—Patient admitted 13 January 1945.

CC: Headache, fever, weakness, associated with a mild rash.

PI: Has had a headache and fever for the past 5 days and the rash appeared this morning.

PE: Essentially negative except for the presence of a generalized "blotchy" macular rash. On 14 January 1945 physical examination revealed moist râles throughout the lungs and he developed a mild productive cough.

Serology: Agglutinations with Proteus OXK:

19 January 1945: Positive..... 1:320
 25 January 1945: Positive..... 1:1280

Case 3.—Patient admitted 15 January 1945.**CC:** Headache, chills, fever, malaise, and anorexia.**PI:** Has been at sick call daily for several days, with evening temperatures ranging from 100° to 102° F.**PE:** Appears acutely ill, perspiring, B.P. 110/56, temperature 103° F. A "blotchy" rash appeared on 17 January. He developed marked pulmonary signs, characterized by coarse breath sounds, bronchial breathing, râles, and a frictional rub.**Serology: Agglutinations with Proteus OXK:**

22 January 1945: Positive..... 1:80
 27 January 1945: Positive..... 1:320

Case 4.—Patient admitted 27 January 1945.**CC:** Chills, fever, aching joints.**PE:** Marked generalized maculopapular rash over the back, chest, abdomen, and extremities. There is a definite "punched-out" indurated lesion on the right side of the scrotum. The chest is negative to auscultation and percussion. The patient appears irritable and disoriented.**Serology: Agglutinations with Proteus OXK:**

27 January 1945: Positive..... 1:40
 3 February 1945: Positive..... 1:80
 6 February 1945: Positive..... 1:1280

Because all 81 patients could not be followed throughout the course of their illness, the correlation of signs and symptoms was not attempted. The following data on the 54 cases that occurred from 8 January to 8 March were obtained by examination of the patients and/or their medical records.

1. Primary skin lesion (eschar) present in 56 percent of cases.
2. Pulmonary symptoms present in 52 percent of cases.
3. Cardiovascular disturbances present in 48 percent of cases.
4. Mental or neurological disturbances in 43 percent of cases.
5. Duration of fever (onset to disposition):
 - (a) Range from 6 to 23 days.
 - (b) Average duration 14 days.

RATS AS A RESERVOIR OF THE DISEASE

Because of the large number of rats present on this island and the fact that the rats are hosts of *Trombicula deliensis* (2), our interest was directed toward determining whether or not they might be an animal reservoir of the *Rickettsiae tsutsugamushi*. Farner and Katsampes state that "Attempts to find natural infections with *Rickettsiae tsutsugamushi* in rats in Java and Sumatra have been unsuccessful although at least one of the species has been shown to be susceptible experimentally."

Through the cooperation of the Rodent Control Officer we were able to examine the blood of 206 rats for the presence of agglutinins for Proteus OXK. The presence of agglutinins for Proteus OXK has been rejected as evidence of the animal being infected with *Rickettsiae tsutsugamushi* and the work done in this laboratory is not presented in an effort to refute that statement. However, the fact that 81 human cases of tsutsugamushi disease have occurred, plus the presence of a known vector, *Trombicula deliensis*, and the finding of 8 rats with a significant titer (1:160 or above), cannot entirely be disregarded.

Distribution by agglutinin titer of 206 rats

[For Proteus OXK, Army Medical School]

Neg.	1:20	1:40	1:80	1:160	1:320	1:640	1:1280
122	18	31	22	4	2	0	2

One reason given that the presence of agglutinins for Proteus OXK in rat serum does not indicate that the rat has the disease is that the rats that show a positive Felix-Weil reaction are infected with an OXK strain of the proteus bacillus. This fact was taken into consideration and an effort made to rule out this possibility.

In addition to examining the rats' blood for agglutinins, a bacteriological examination of the contents of the lower gut was made on 129 rats. After bleeding the rat the abdomen was opened and a culture was made on Bacto SS Agar from the contents of the lower gut. After incubation for 24 hours at 37° C. colorless colonies were transferred and routine fermentation tests were made on pure cultures. Strains that proved to be members of the proteus group by fermentation tests were grown out on agar slants. From these slants an antigen was prepared by Bridges' method—the organisms were killed with absolute alcohol, the alcohol was removed and a saline suspension made of the dead bacteria.

Organisms belonging to the proteus group were isolated from 6 of the 129 rats by the method described. From a patient who had the characteristic symptoms of tsutsugamushi disease, plus an agglutinin titer of 1:2560 for a known antigen (Proteus OXK, Army Medical School) a sufficient quantity of a known positive serum was obtained to test the unknown strains of proteus bacilli obtained from the rats.

Serial dilutions were set up from 1:20 to 1:2560, using the aforementioned known positive serum. One-half cc. of the antigen described above was added to each dilution. The tubes were then placed in a water bath at 56° for 2 hours and then in a refrigerator for 18 hours. They were then examined for evidence of agglutination. The 6 strains isolated were tested in this manner and none showed any evidence of

agglutination in any dilution. It is evident that the strains so isolated, although proved to be proteus organisms by fermentation tests, were not OXK strains.

Blood samples were collected from 50 men (naval personnel) at random, as they reported to sick call at the dispensary. The average time of residence on this island for these men was 6.5 months. These bloods were examined for the presence of agglutinins against Proteus OXK (Army Medical School Antigen) and all were negative.

SUMMARY

1. Eight rats out of 206 showed a significant titer (1:160 or above) for Proteus OXK.
2. Proteus strains were isolated from 6 rats. None of these strains was agglutinated by a known positive serum.
3. Fifty random samples of human blood failed to show agglutination of a known antigen (Proteus OXK).

REFERENCES

1. FARNER, D. S. and KATSAMPES, C. P.: Tsutsugamushi disease. U. S. Nav. M. Bull. 43: 800-836, October 1944.
2. WHARTON, G. W., JR.: Report on tsutsugamushi fever, epidemiology, on Samar, P. I. (Special Report). Naval Medical Research Unit No. 2. November 1945.



MIGRATION AND PHYSICAL DIFFERENTIATION: A COMPARISON OF WITH AMERICAN-BORN CHINESE

Measurements of Chinese males born and raised in the United States differ in certain specific respects from those of Chinese immigrants born in China. These differences consist in an increase in stature and in all measurements highly correlated with stature: notably all measurements of the trunk and limbs other than chest depth. Of the body indices, the thoracic, brachial, hand and foot indices tend to be lower in the American-born. Such changes are not limited to Chinese in continental United States. Similar tendencies have been noted for Chinese and Japanese born in and immigrant to Hawaii. The typical Oriental youth born and brought up in the United States or Hawaii, when compared with immigrants from the region from which his ancestors have come, differs in ways which may be ascribed to an "environmental growth factor." He is taller with longer arms and legs, relatively slenderer hands and feet, and flatter chest. His head is likely to be shorter but broader and his nose to be relatively narrower. He has more body hair. Such changes are exemplified in Chinese in America and seem to signify a process caused by changed dietary factors, or otherwise, attendant upon the migration of peoples.—LASKER, G. W.: Migration and physical differentiation; comparison of immigrant with American-born Chinese. Am. J. Phys. Anthropol. 4: September 1946.

EVALUATION OF THERAPEUTIC AGENTS IN PLAGUE

A Review of the Literature¹

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A search for an effective therapeutic agent in plague is probably as old as the disease itself. Hippocrates differentiated the bubonic from the pneumonic forms in his book on epidemics, but leaves no record of any effective method of treatment being used. The rat was used as a symbol of pestilence by several races of antiquity (44).

The great pandemic of the fourteenth century brought forth several different regimes of treatment. Guy de Chauliac (1300-1368) held the Arabian view that medicine was of no avail, and that flight was the only method of survival. Gentile da Foligno (d. 1348) advised bleeding, purging, vinegar baths, and fires of odoriferous woods, while Santa Sofia, another Italian teacher of the same period, mentions treatment of the tumid glands and care of the cardiac complications. Leeches were used on the buboes (18).

No specific therapy was developed until after 1894 when Yersin and Kitasato discovered the specific causative micro-organism. The evolution of improved symptomatic treatment in the intervening centuries added to the comfort of the patient, if it did not greatly alter the mortality. Fever, vomiting, and restlessness are the problems for which supportive therapy is usually used.

Complete bed rest is necessary during the acute phase of the illness and for at least 10 days after the temperature is normal. Death has not infrequently occurred with the first activity after an apparent recovery, probably due to myocardial injury. Morphine is of great value during the acute phase. Hyoscine in 0.0003 to 0.0008 gram doses is effective for the restlessness.

Fever is best controlled by sponging the patient with lukewarm water. The use of antipyretics is not advised.

¹ Appreciation is expressed for the assistance of the Department of Epidemiology, U. S. Naval Medical School, National Naval Medical Center, Bethesda, Md.

The diet should be liquid during the acute phase and fluids should be forced. Vomiting may require the use of intravenous fluid with alkalies such as sodium lactate in physiologic saline solution. Stimulants such as caffeine may be useful in some cases.

Treatment of the buboes is varied, but there is general agreement that surgery is to be avoided unless the lesions are suppurative. If incision is performed, iodoform dressings are advised. Many preparations have been used for injection into the bubo, without any proving to be of definite value.

Specific therapy began in 1895 when Yersin's antiserum was introduced. The evaluation of a particular form of therapy presents many difficulties in this disease. Dowdeswell (11) has discussed the estimation of the value of new forms of therapy in plague. The preferred method of investigation would seem to be the study of a large number of cases, the conditions differing only in respect to the particular treatment to be tested. The best method of doing this is the use of alternate cases without prejudice as to the form of treatment given. The most important factors to be considered in such a study in plague are:

1. The variation in virulence of infection in different epidemics, in different years, and different places. The mortality in individual epidemics varies considerably. Reports of therapeutic agents in plague are usually from scattered parts of the world on small series of cases in which combined forms of treatment are used.
2. The improvement or other change in hospital facilities, diagnosis, general condition of living or nutrition and in transportation and collection of patients.
3. The use of specific prophylactic treatment with vaccine. Reports frequently do not state whether the patients have previously received vaccine. The mortality rate in Egypt in the years 1939 and 1940 was 24.8 percent in vaccinated and 38.7 percent in nonvaccinated, 555 cases being observed (23).

TABLE 1.—*Mortality rate of plague in various races*

India ¹			China ²	
Race	Mortality		Race	Case mortality
	Cases	Percent		Percent
Europeans.....	15	33.3	Europeans.....	18.2
Parsees.....	115	40	Indians.....	77
Mohammedans.....	151	44.3	Japanese.....	60
Native Christians (Goans).....	217	44.7	Chinese.....	93.4
Hindus.....	547	55		
Japanese.....	1	0		
Chinese.....	1	0		
Jews.....	3	66.6		
Eurasians.....	1	100		

¹ Adapted from Choksy (8).

² Adapted from Manson-Bahr.

4. The variation in individual resistance, race, sex, age, concomitant disease, nutritional status, etc. The mortality rate is usually lower for Europeans than for other races, the comparative figures being shown in table 1. The general health, nutritional status, and hygienic conditions of various nationalities are probably the determining factor in these rates. The chances of recovery are slightly better for men than for women. Kamal (23) found a fatality rate of 34.8 percent in men and 39.6 percent in women in a series of 395 bubonic cases. Table 2 shows the difference in mortality with age.

5. The duration of illness before beginning treatment. This is illustrated in the case of antiserum in table 5 and in the case of sulfapyridine in table 10.

TABLE 2.—*Fatality rate by age group in the 1939 and 1940 Egyptian epidemics*¹

Age group	Fatality rate in 1939	Fatality rate in 1940
	<i>Percent</i>	<i>Percent</i>
0-15	24.4	30.3
15-35	36.4	40.7
35-55	38.7	42.1
55	66.6	59.3

¹ Adapted from Kamal (23).

6. Some form of voluntary selection of cases, as when very acute ones die before admission where transportation is difficult.

7. The stage of the epidemic in which trials are made.

8. The mortality rates also depend to a large extent on the number of cases which are septicemic or pneumonic, as those cases are usually fatal. The location of the bubo is also related to the mortality as is shown in table 3.

TABLE 3.—*Fatality rates in bubonic plague in relation to the site of the bubo*¹

Site	India 1937		Egypt 1939		Egypt 1940	
	Cases	Fatality rates	Cases	Fatality rates	Cases	Fatality rates
		<i>Percent</i>		<i>Percent</i>		<i>Percent</i>
Inguinal.....	72	31.0	65	18.4	170	32.3
Axillary.....	17	41.2	24	37.5	74	48.6
Neck.....	3	66.6	52	44.2	118	36.4
Multiple.....	4	0	18	33.3	31	38.7

¹ Adapted from Kamal (23) (24) and Walker (50).

Experimental animals have been widely used to evaluate the effectiveness of the new agents. Rats, mice, and guinea pigs are the ones usually employed. Sokhey (39) of the Haffkine Institute in Bombay advises the use of inbred white mice which are highly susceptible, and the individual response of members of the species is constant. Ten virulent plague organisms give a 100 percent mortality.

ANTISERUM

The first antiserum was produced in 1897 by Yersin, Calmette, and Borrel (52). Horses were inoculated with dead organisms and later

with increasing quantities of living virulent organisms. Between 1897 and 1910 other antisera were produced—Lustig's Terni's, Haffkine's, and Brazil's being the best known (41) (6) (50). Large doses of 100 to 250 cc. were used intravenously and frequently repeated. The results obtained from these and other forms of treatment are shown in table 4. The mortality with the use of these early antisera varied from 65 to 82 percent as compared with 70 to 85 percent in the untreated. The results were not impressive in lives saved, but there was evidence of prolongation of life and amelioration of symptoms. Better results were obtained in Ecuador, where case mortality was lower than in India, where they were more extensively used.

TABLE 4.—*Mortality in plague treated with various therapeutic agents*

Therapeutic agent	Investigator	Year	Treated cases		Control cases		Probability percent ¹
			Number	Case mortality	Number	Case mortality	
				Percent		Percent	
Antiplague serum	Yersin (41)	1899-1907	226	74.3	231	70.5	
	Yersin (41)	1908-10	146	65.1	146	71.9	20.82
	Lustig (41)	1897-1903	608	71.7	609	79.1	1.02
	Terni (41)	1901-4	110	80.9	110	81.8	86.52
	Brazil (41)	1902-4	70	82.8	70	85.7	63.87
	Rowland (33) (nucleo-protein serum).	1911-12	76	68.4	76	77.6	19.73
	Naidu (28) (sheep serum).	1932-33	179	60.0	143	85.0	(2)
	Sokhey (38)	1936-37	94	25.5	80	62.5	(2)
	Sokhey (38)	1938	69	27.7	55	65.0	.001
	Wagle and Sokhey (49).	1941	70	28.5	³ 82	52.4	.19
Convalescent serum	Walker (50)	1937	48	16.7	48	47.9	.05
Prontosil	Carman (5)	1938	6	50.0			
Sulfanilamide	Kamal (23)	1940	31	38.7	⁴ 195	29.1	
Sulfapyridine	Kamal (23)	1940	50	30.0	⁴ 195	29.1	
	Wagle and Sokhey (49).	1941	53	24.5	³ 82	52.4	.05
Sulfathiazole	Plum (49)	1942	413	55.0			
	Wagle and Sokhey (49).	1941	32	15.6	³ 82	52.4	.001
Sulfanilamide plus serum.	Kamal (23)	1940	32	28.1	⁴ 195	29.1	90.77
Sulfapyridine plus serum.	Kamal (23)	1940	37	8.1	⁴ 195	29.1	.014
Bacteriophage	Advier (1)	1932	35	43.0			
	Couvy and Popoff (10).	1930	21	28.0			
Bacteriophage in bubo and serum.	Estrade (13)	1934	30	20.0			

¹ Times in 100 this would occur by chance alone.

² Less than 0.001.

³ Iodine given.

⁴ Serum given.

S. Rowland, of the Lister Institute, in 1912 prepared a serum by immunizing horses with a solution of the nucleoprotein from plague bacilli. A marked curative effect was demonstrated in rats when the antiserum was injected 24 hours after the animal had been infected with virulent plague bacilli. Six hours after infecting 10 rats with plague bacilli, 5 cc. of this serum were injected, with only 1 death occurring, while when Yersin's serum was used in a similar experi-

ment, 8 rats died. Its use in humans did not, however, lower the case mortality significantly (33).

Naidu (28) and Sokhey (38) at the Haffkine Institute at Bombay in 1931 prepared an improved serum by immunizing sheep. This was used in Hyderabad and Deccan with a mortality of 35 percent in treated cases and 70 percent in untreated controls. Serum from buffaloes was tried at Poona with similar results.

Sokhey (38) (41) developed a new serum at the Haffkine Institute in 1935, using horses, which in a small number of cases gave a mortality of 29 percent in treated cases, compared with 58 percent in the controls. In mice it was found to be 10 times as potent as the previous sera, requiring smaller doses. The doses used in treatment were only 20 cc., repeated till a total of 60 to 160 cc. was given. A subsequent report in 1936 gave a mortality of 18 percent, while in controls it was 75 percent. Its further use in 1937 and 1938 has confirmed the remarkable effectiveness of this antiserum. (See table 4.) Some of the problems which Sokhey (41) mentions in serum preparation are:

1. The quantitative determination of the virulence of cultures used to immunize animals.
2. The maintenance of virulent cultures over a period of years.
3. The rendering of cultures avirulent without reducing their antigenic properties.
4. The determination of optimal temperature for growth of cultures.
5. The preparation of an optimal media for their growth.

Pirie and Grasset (29) in 1938 used rats to test the effectiveness of serum obtained from horses, using a live avirulent strain injected intravenously into the horses for a period of three months, the doses reaching 400,000 million organisms. Comparison was made with serum prepared by the use of killed organisms and the highest rate of survival was found with the antiserum obtained by the immunization with avirulent organisms.

Bonebakker (3) in 1940 in the Dutch East Indies used antiserum in 111 of 154 cases, 10 cc. being given intravenously and 10 cc. subcutaneously about the bubo, and then 5 cc. intravenously and intramuscularly each day for 5 days. The results were not encouraging with this regimen and were no better than with bacteriophage.

Clark and Goldberg (8) report the recovery of a pneumonic case in which the patient had received vaccine following the use of 400 to 500 cc. of serum intramuscularly and subcutaneously.

To be effective, serum must be given early. If it is given at the time of infection in rats, 60 percent inoculated with plague bacilli survive and 40 percent die. When antiserum was given 24 hours after infection, 40 percent survived and 60 percent died. In another series there was a 10-percent mortality when serum and the infecting inocu-

lation were given simultaneously and a 4-percent mortality when serum was given 24 hours after infection and 66.6-percent mortality when serum was delayed 48 hours (45). Table 5 illustrates the relation of the duration of illness to the mortality rate in serum-treated cases; the hospital cases and those seen in private practice being shown separately. In a group of 1,081 patients receiving antiserum, the mortality for the total group was 49.6 percent, and in cases brought to the hospital it was 57 percent, while in those treated at home it was 39.9 percent.

TABLE 5.—*The case mortality of plague by the day of illness on which serum therapy was begun*¹

Day of duration of illness	Hospital cases		Private practice cases	
	Number	Case mortality	Number	Case mortality
		<i>Percent</i>		<i>Percent</i>
First	37	45.9	116	28.4
Second	138	61.5	77	42.8
Third	145	66.8	37	67.5
Fourth	72	56.9	5	40.0
Fifth	36	58.3	7	71.4
Sixth	7	57.1	1	100.0
Seventh	3	100.0	1	100.0

¹ Adapted from Choksy (6).

The plague bacillus has three fractions which are antigenic: The nucleoprotein, the envelope, and the soma. Antisera have been produced which contain antibodies for the nucleoprotein and the envelope substance, but these appear to have no advantage over antiserum produced by the use of an avirulent strain with all three antigenic fractions (21) (22). Schultze (36) found that the anti-envelope substance was contained in the pseudoglobulin of buffalo serum and the euglobulin of sheep serum.

Strong (45), in his investigations in the Philippines in 1907, found that plague antiserum possessed no bactericidal action, but was anti-infectious. Animals are protected, but the bacilli are not destroyed. In the immune animal more bacilli are ingested by phagocytes than in the nonimmune, demonstrating the opsonic action of the serum. No antitoxic action is present. This explains in part the poor results of serum therapy in septicemic cases. The best results are obtained with serum when the infection is confined to the lymph channels. The anti-infectious power of the antiserum explains its prophylactic value. This passive immunity produced by the use of antiserum is, however, of short duration.

Convalescent serum was used by Walker (50) in 1937 in 48 cases. It was obtained from convalescents when the temperature had been normal 10 to 15 days. Forty cc. of blood were withdrawn and refrig-

erated 12 hours in a sterile tube. Kahn positive blood being excluded. The serum was separated and given intramuscularly, 10 to 20 cc. being given in 3 successive days. There was in most cases a drop in temperature following injection, and the temperature usually remained normal after the third injection if it was effective. The earlier it was given, the more effective it was, although it had no effect on the supuration of the buboes. Of the 48 cases treated, 8 died (16.7 percent mortality) and the 48 controls had 23 deaths (47.9 percent mortality). Some of the disadvantages of this form of treatment are the difficulty in getting convalescent serum and the lack of standardization of the procedure. The results are, however, encouraging.

There is evidence that the use of antiplague serum has been effective in reducing the mortality in plague. Serum is of great prophylactic value, but passive immunity disappears rapidly, lasting but a few days (45).

BACTERIOPHAGE

Bacteriophage was introduced as an agent in the treatment of plague in 1925 by d'Herelle (17). A strain of bacteriophage isolated in Indochina in 1920, which was found effective for *Pasturella pestis*, was used in four cases in Alexandria. One to two cc. were injected into the bubo and further injections advised if the temperature remained elevated. Two of these first four cases required incision of the bubo following treatment. Intravenous injection was suggested for septicemic and pneumonic cases. To be effective the bacteriophage used must be of great virulence. It should be tested for its ability to lyse a 24-hour culture in less than 2 hours. Most subsequent investigators have not been able to confirm the effectiveness of bacteriophage. A few workers have reported favorable results on small series of cases without controls. Advier (1) in Senegal reported its use in 35 cases with 20 recoveries, 43 percent mortality. Couvy and Popoff (10) used it locally and intravenously in 21 severe cases with 15 recoveries, 28 percent mortality. Girard (15) reported the recovery of one pulmonary infection with the injection of bacteriophage. In his use of phage he found that it rapidly lost virulence and became useless in 3 months.

Zhukov-Verezhnikov and Favorisova (21) in 1935 found that guinea pigs injected with phage and plague cultures succumbed as rapidly as controls. Normal serum apparently impedes the lytic action of phage in the plague bacilli. The same investigators tested various sera and bacteriophage for its ability to prolong life of infected test animals with the following results:

	<i>Life of test animals (days)</i>
Paris serum (horses immunized with living organisms) ..	23 to 67
Nucleoproteid serum	6 to 7
Antienvelope serum	4 to 9
Bacteriophage	4
Controls	4

Estrade (13) used bacteriophage in the bubo and serum intravenously with a small series of cases. His results were as follows:

	Cases	Deaths	Case mortality
	<i>Number</i>	<i>Number</i>	<i>Percent</i>
Serum 40 cc. intravenously and repeated 3 times	10	5	50
Phage intravenously plus serum intravenously	9	6	66.6
Phage in the bubo plus serum intravenously	30	6	20

Medical Inspector General Sorel (43) in 1937 reviewed the treatment of plague in the French colonies for the preceding 2 years and found that bacteriophage used intravenously and subcutaneously in the bubo gave effects no different than serotherapy alone. He concluded that the action of bacteriophage *in vitro* is not apparent clinically.

OTHER AGENTS

Chemotherapeutic agents have been extensively used to treat plague. Iodine has long been a favored form of treatment in India. Orally it is given 5 drops every 3 hours, and intravenously, 7 minims of the tincture in physiologic saline solution daily. There has been little proof of its effectiveness, and it is now used in control cases for other forms of therapy.

Mercurochrome 220 soluble (dibromo-oxy-mercury-fluorescein) has been widely used with few encouraging results. It is given in 1-percent solution in water intravenously, 2 to 5 mg. per kg., usually 20 cc. of 1-percent solution being given.

Numerous other chemotherapeutic agents have been tried. The phenols, mercurated phenol, phthalein, dyes, resorcinol and, mercurated trypan blue were effective *in vitro* but not clinically (4). Preparations tried and found not to be effective include: Quinine, neosalvarsan, methylene blue, formalin, germanin, and merthiolate.

Ommadin, a vaccine preparation, was used in 1930 in Java by Schut (35), and he believed it to have some protective value in pneumonic contacts, but it was not an effective form of treatment.

Penicillin is ineffective *in vitro* and has not been effective in laboratory animals (53). The new antibiotics offer promise in the field of plague therapy.

SULFONAMIDES

The most important contribution to plague therapy has been the use of sulfonamides. The first report of their use was by John A. Carman (5) in 1938 in East Africa. He tried prontosil at the suggestion of R. J. Harley-Mason. The first case in which it was used had a bubo, a smear from which was positive for plague bacilli. Six 5 cc. intramuscular injections were given, and the temperature fell to normal in 48 hours. A second similar case received 2.5 cc. injections and the temperature became normal in five days. Another patient was admitted in an unconscious state and given 5 cc. six times in 3 days, which brought the temperature to nearly normal. The patient then absconded, to return a day later with temperature of 101°. Further injections were given with a cure resulting. Three other cases admitted *in extremis* received prontosil and died shortly after admission before adequate dosage could be given. Of the six cases treated, three recovered and three died. These results led to further and more adequate trials by many workers.

First let us review the effectiveness of sulfonamides in experimental animals infected with plague. Schutze (37) in 1939 used 3 sulfonamide preparations in rats infected with 100,000 organisms in 0.5 cc. of broth culture grown 2 days at 37° C. He also infected mice with 100 organisms in diluted broth cultures. He found sulfapyridine given at the time of infection, 200 to 640 mg., most efficacious for both rats and mice. Soluseptazine (disodium- α , γ -disulfo- γ -phenyl-propyl sulfanilamide) was effective for rats, but not mice. Diamino-sulfone (diamino-diphenyl sulfone) was effective for mice, but not rats. Girard (14) about the same time used sulfapyridine in a small series of mice, as well as serum and sulfapyridine together, and demonstrated curative effects. In this and subsequent investigations he found sulfapyridine effective 48 hours after infection. It was found necessary to prolong sulfapyridine treatment 15 days to avoid fatal relapse. Sokhey (38) in Bombay found that both sulfapyridine and sulfathiazole possessed remarkable curative action in mice. He demonstrated that mice infected with 60 to 120 organisms and given sulfathiazole 10 mg. twice a day for 10 days, starting at the time of infection or within 24 hours, would have 80 percent cures. Sulfathiazole given in larger doses of 40 mg. twice a day for 10 days, started 48 to 72 hours after infection, gave 80 to 90 percent cures. As septicemia did not develop till 48 hours after infection, the results were but little different when treatment was delayed 24 hours. Sulfathiazole was found superior to sulfapyridine and as effective as the Haffkine Institute antiplague serum.

Durand (12) found that large doses of sulfapyridine protected mice against 10,000 MLD of plague bacilli. He gave the drug in some cases for 6 to 7 days before infecting the animals. The mice which did not survive were in many cases found to be free of plague bacilli at autopsy, while a few had latent infections. Savino and Morales Villazon (34) in Argentina in 1942, using guinea pigs, found that sulfanilamide did not protect against minimal lethal doses, while sulfathiazole and sulfapyridine protected against as much as 10,000 MLD. Animals receiving 2 grams of sulfathiazole or sulfapyridine before infection with plague bacilli lived 14 days, while those receiving 0.5 gram lived only 7 days. When plague developed following the use of sulfonamides, it was bubonic in type or could only be demonstrated by culturing viscera or planting the bone marrow in agar. This phenomenon of latent infections has also been noted in wild rodents in whom no macroscopically visible lesions are found, but cultures obtained from their viscera are positive (27).

Sulfadiazine was used by Phillips and Barnes (31) in 1943 in mice in comparison with sulfathiazole, succinylsulfathiazole, and controls. The superiority of sulfadiazine is demonstrated in table 6. Wayson and McMahon (51) in 1944 gave sodium sulfadiazine, 100 grams subcutaneously and 100 mg. orally as an initial dose and 100 mg. orally thereafter as indicated to 26 guinea pigs to maintain a blood level of 4 to 7 mg. percent, the sulfadiazine being given after the papule at the site of inoculation developed. The drug did not prevent the formation of a bubo in most cases, but the mortality was only 27 percent in treated animals as compared to 92 percent in controls. They found that guinea pigs infected by flea bites had a shorter course and earlier death than those mechanically inoculated.

TABLE 6.—*Effect of sulfonamides on plague infections in mice*¹

Drug	Number of mice	Daily dose (mg.)	Percent survived
Group A:			
Sulfathiazole.....	19	40.8	73.6
Sulfadiazine.....	10	28.4	90.0
Controls.....	19		10.5
Group B:			
Sulfadiazine.....	20	19.8	80.0
Succinyl-sulfathiazole.....	20	14.8	10.0
Controls.....	20		5.0

¹ Adapted from Phillips and Barnes (31).

Following Carman's clinical use of prontosil in 1938, Vine (47) treated three cases with the same drug and all recovered. The first large series of cases treated was by Kamal et al. (23) in the Egyptian epidemic of 1940. Sulfapyridine and sulfanilamide were used in doses of 2 grams initially and 1 gram every 4 hours thereafter. Antiserum

and sulfonamides were used in combination. Sulfanilamide was found ineffectual. Sulfapyridine alone was about as effective as serum alone, while the combination of serum and sulfapyridine gave the best results, as shown in table 7. The mortality was lower in all forms of treatment in those who had been vaccinated than in the nonvaccinated, the mortality being 30.7 percent in the nonvaccinated and 17.9 percent in the vaccinated in the treated group.

TABLE 7.—*The fatality rates of plague for various forms of treatment, Egyptian epidemic, 1940*¹

Treatment	Cases	Deaths	Fatality rate
			Percent
Serum 80 cc. or more per day.....	195	57	29.1
Sulfapyridine 6 gm. per day.....	50	15	30.0
Sulfanilamide 6 gm. per day.....	31	12	38.7
Sulfapyridine plus serum.....	37	3	8.1
Sulfanilamide plus serum.....	32	9	28.1

¹ Adapted from Kamal (23).

In India in 1941 Wagle and Sokhey et al. (49) studied 237 cases of bubonic plague, using four forms of treatment:

1. Iodine intravenously, 0.5 cc. in 10 cc. of distilled water five times.
2. Antiplague serum 20 cc. intravenously initially and 20 cc. subcutaneously 6 hours later and daily for five days if needed.
3. Sulfapyridine 1 gram immediately and 0.5 gram every 4 hours for 7 days.
4. Sulfathiazole in the same dosage.

The results are shown in table 8. Alternate cases were used, demonstrating the effectiveness of sulfathiazole and the importance of septicemia in the effectiveness of the drug. The doses used were unfortunately very small and even greater reduction in mortality might be anticipated with larger dosage. Four of six pneumonic cases were treated with sulfathiazole and two of these cases lived to the fourth and eleventh day, respectively, while the other pneumonic cases died in 3 days. The blood became sterile in the cases treated with sulfathiazole.

TABLE 8.—*Results of treatment of plague cases, India, 1941*¹

Treatment	Plague cases			Cases with septicemia		
	Cases	Deaths	Mortality	Cases	Deaths	Mortality
			Percent			Percent
Antiplague serum.....	70	20	28.5	33	20	60.6
Sulfapyridine.....	53	13	24.5	30	13	43.0
Sulfathiazole.....	32	5	15.6	12	5	41.8
Iodine (controls).....	82	43	52.4	40	38	95
Total.....	237	81	34	115	76	66

¹ Adapted from Wagle, Sokhey, et al. (49).

Sokhey and Wagle (42) in another series of cases used larger doses of sulfathiazole, 10 grams the first day and 7.5 grams a day for 4 to 5 days, and then smaller doses to maintain a blood concentration of 5 to 10 mg. percent. It was their opinion that the degree of septicemia was the deciding factor in the outcome. They graded the degree of septicemia as mild if 0.25 cc. of blood gave less than ten colonies, and severe if it grew more than ten colonies. Septicemia rarely developed after treatment was started. All of 10 pneumonic cases terminated fatally. The results are shown in table 9.

TABLE 9.—*Results of treatment of plague (with and without septicemia) India, 1941*¹

Treatment	Case Mortality	
	Without septicemia	With septicemia
	Percent	Percent
Antiplague serum.....	23.5	69.0
Sulfapyridine.....	27.0	72.2
Sulfathiazole.....	20.8	55.4
Sulfathiazole plus antiplague serum.....	20.0	38.1
Iodine intravenously.....	53.6	96.4

¹ Adapted from Sokhey and Wagle (42).

In 1942 the Report of the Plague Researches under the Director of the Haffkine Institute (20) in Bombay, stated that "a marked advantage was noticed in favor of the combined treatment with sulfathiazole plus antiplague serum."

In the epidemic in Nairobi in 1942, Plum (30) treated 547 cases with sulfapyridine, 2 grams immediately and 1 gram every 4 hours till the temperature was normal 24 hours. They were treated in two hospitals. In the Infectious Disease Hospital, 413 cases were treated, of which 13 were septicemic and 12 pneumonic, with a general mortality of 55 percent. In the Native Civil Hospital 134 cases, of which only 28 were the less fatal bubonic type, were treated, with a 95-percent mortality. One pneumonic case, which had received plague vaccine 4 days before illness, recovered, receiving 37 grams of sulfapyridine. The higher mortality in this epidemic may be the result of many cases starting the treatment late. The importance of early treatment with sulfapyridine is demonstrated by table 10. Sulfapyridine was used prophylactically to a limited extent, three cases occurring following its prophylactic use.

Girard (16) in 1941 treated 19 cases with 6 to 10 grams of sulfapyridine a day, and continued treatment for 12 days. After the fall in temperature, the dose was lowered to 1 to 2 grams a day. Fifteen of the cases were cured, with no cures occurring in pneumonic cases.

TABLE 10.—*Effect of the duration of illness before commencing sulfapyridine on the mortality in plague*¹

Number of days ill before treatment begun	Number of cases	Number of deaths	Percent of mortality
1.....	33	4	12.1
2.....	72	16	22.1
3.....	17	6	35.3
4 or more.....	40	35	87.5

¹ Adapted from Plum (30).

Chopra et al. (7) describe one effective cure with sulfapyridine.

deVillafane Lasta et al. (48) in South America used sulfathiazole in 1941 successfully in three cases. In 1942, 39 patients were treated with 10 grams of sulfathiazole a day, with a mortality of 23 percent, as compared to a 71 percent mortality with serum. In reviewing plague mortality in Argentina in 1942, Cossio (9) found a 60 percent mortality in 52 cases, while in previous years it had been 90 percent, and he credits the reduction to the use of sulfonamides.

Burga Saavedra (2) successfully treated two bacteriological proved cases in Peru in 1942.

Kallat (25) in India in 1944 treated 290 cases with sulfathiazole, sodium sulfapyridine, or sulfapyridine, 7 grams the first day, then 4 grams for 2 days, and then 3 grams a day till the temperature was normal for 24 hours. The cases also received iodine intravenously. The mortality was 42 percent in treated cases and 56 percent for all cases, treated and untreated. The high mortality in the treated cases may be due to the fact that treatment was begun late in many cases.

Townsend (46) in 1942 at Port Said found sulfapyridine, 12 grams for 2 days and 6 grams a day thereafter, of little effect in a few cases of bubonic plague, and of no effect in nine pneumonic cases.

It is apparent from this work with experimental animals and humans that sulfadiazine is superior to other sulfonamides in the treatment of plague. Sulfathiazole is the drug of second choice if sulfadiazine is not obtainable. Sulfapyridine is even less effective, and sulfanilamide is of little or no value. Doses of sulfadiazine should be large initially, giving a blood level of 15 to 20 mg. per 100 cc. for the first 4 to 5 days. Smaller doses should then be given to maintain a blood level of 10 mg. per 100 cc. for 10 to 15 days (53). In fulminating cases intravenous sodium sulfadiazine (5 percent solution in sterile distilled water) is advisable, with an initial dose of 6 to 8 grams being given slowly. Smaller doses of 3 or 4 grams may be given every 6 hours until oral doses can be tolerated (53).

CONCLUSIONS

Sulfadiazine is the drug of choice in the treatment of plague. It must be given early in the illness in doses of 12 to 30 grams on the first

day and smaller doses for 12 days after the temperature is normal. The best results have been obtained when the combined treatment with antiplague serum and sulfadiazine has been used. Antiserum must be used early and when used alone is not as effective as sulfadiazine. Convalescent serum may be of value, but it is not always available. Septicemic plague has a higher mortality than the bubonic form, but does respond to sulfonamide therapy. The pneumonic form of plague is generally fatal, but exceptions are recorded when antiserum, bacteriophage, and sulfapyridine have been used.

Antiplague serum and sulfadiazine are of value prophylactically. In cases of exposure to plague, therapeutic doses of sulfadiazine are advisable. The production of a latent plague infection such as has been noted in animals, should be considered.

Following the war, more effective antiserum and antibiotics may be available.

REFERENCES

1. ADVIER, M.: Etude d'un bactériophage antipesteux. *Bull. Soc. path. exot.* 26: 94-99, January 11, 1933; abstr., *Trop. Dis. Bull.* 30: 531, August 1933.
2. BURGA SAAVEDRA, V.: Dos casos de peste en su forma búbónica tratados con éxito por sulfatiazol. *Actual méd. peruana* 8: 26-27, June 1942; abstr., *Trop. Dis. Bull.* 40: 306, April 1943.
3. BONEBAKKER, A.: Serum therapy of plague. *Geneesk. tidschr. v. Nederl.-Indië* 80: 2502-2511, October 2, 1940.
4. CAIUS, J. F. and NAIDU, B. P. B.: Chemotherapy of bubonic plague. *Far Eastern Assoc. Trop. Med., Tr. Seventh Congress, British India* 3: 481-487, 1927.
5. CARMAN, J. A.: Prontosil in treatment of oriental plague. *East African M. J.* 14: 362-366, February 1938.
6. CHOKSY, KHAN BAHADUR N. H.: On recent progress in the serum-therapy of plague. *Brit. M. J.* 1: 1282, May 30, 1908.
7. CHOPRA, R. N., DE MONTE, A. J. H., and CHATTERJEE, B. C.: Case of plague successfully treated with sulphapyridine. *Indian M. Gaz.* 76: 89-90, February 1941.
8. CLARK, B. M. and GOLDBERG, S.: Pneumonic plague; recovery in proved case. *South African M. J.* 17: 57-60, February 27, 1943.
9. COSSIO, P.: Peste. *Bol. Sanitario, Buenos Aires* 6: 167-168, April-June 1942; abstr. *Trop. Dis. Bull.* 40: 773, October 1943.
10. COUVY, L. and POPOFF: Essais de traitement de la peste par le bactériophage. *Bull. Soc. path. exot.* 23: 618-629, June 1930; abstr., *Trop. Dis. Bull.* 28: 386, May 1931.
11. DOWDESWELL, R. M.: Estimation of value of any new treatment in disease with special reference to plague. *East African M. J.* 18: 258-260, December 1941.
12. DURAND, P.: Action du dagénan dans l'infection pesteuse. *Arch. Inst. Pasteur de Tunis* 28: 96-106, March 1939; abstr., *Bull. Soc. path. exot.* 32: 267-271, 1939.
13. ESTRADA, M. F.: Contribution à l'étude de l'action du bactériophage dans le traitement de la peste bubonique. *Bull. Soc. Path. Exot.* 27: 609-611, June 13, 1934; abstr., *Trop. Dis. Bull.* 31: 884, December 1934.

14. GIRARD G. and GIRARD, M.: Remarquable efficacité du corps "693" M. B. p. aminobenzène sulfamido-pyridine dans le traitement de la peste expérimentale (note préliminaire). Bull. Soc. path. exot. **32**: 480-482, 1939.
15. GIRARD, G.: Considération sur le traitement de la peste par le bactériophage. (A propos du mémoire de Mm. Couvy et Popoff). Bull. Soc. path. exot. **23**: 936-942, 1930.
16. GIRARD, G.: Le traitement de l'infection pesteux par les corps sulfamides. Peste expérimentale et peste humain. Bull. Soc. path. exot. **34**: 37-48, 1941.
17. d'HERELLE, F.: Treatment of bubonic plague by bacteriophage. Presse Méd. **33**: 1393-1394, October 21, 1925.
18. HECKER, J. F. C.: Epidemics of the Middle Ages. Translated by B. S. Babington. John Childs and Sons, Printers, London, 1844.
19. HIRST, L. F.: Plague, in British Encyclopedia of Medical Practice, Sir Humphrey Rolleston, editor, **9**: 675-698. Butterworth & Co. Ltd., London, 1938.
20. INDIAN RESEARCH FUND ASSOCIATION: Report of Scient. Advisory Board, Year of 1942. p. 54.
21. ZHUKOV-VEREZHNIKOV, N. N., and FAVORISOVA, B. Y.: Nature and significance of bacteriophage phenomena; action of bacteriophage in vivo on plague bacilli. Vestnik mikr., epidemiol. i parazitol. **14**: 199-204, 1935; abstr., Trop. Dis. Bull. **33**: 371, May 1936.
22. ZHUKOV-VEREZHNIKOV, N. N., and LIPATOVA, T.: Immunologic studies on plague. Vestnik mikr., epidemiol. i parazitol. **12**: 257-266, 1933; abstr., Trop. Dis. Bull. **31**: 886, December 1934.
23. KAMAL, A. M., GAYED, I., and ANWAR, M.: On epidemiology and treatment of plague in Egypt; "1940 epidemic." J. Egyptian Pub. Health A. **16**: 31-103, January 1941.
24. KAMAL, A. M.: On epidemiology of plague in Assint Province in years 1938-1939. J. Egyptian Pub. Health A. **16**: 1-30, January 1941.
25. KALLAT, S.: Recent experiences in symptomatology and treatment of plague. Indian M. Gaz. **79**: 168-169, April 1944.
26. MEARA, F. S.: Treatment of Acute Infectious Disease. 2d edition. The Macmillan Co., New York, 1921.
27. MEYER, K. F.: The known and the unknown in plague. Am. J. Trop. Med. **22**: 9-36, January 1942.
28. NAIDU, B. P. B.: Serum therapy of plague. Bombay Med. J. **2**: 302-305, Nov.-Dec. 1933; abstr., Trop. Dis. Bull. **31**: 884-885, December 1934.
29. PIRIE, J. H. and GRASSET, E.: Plague; killed versus live organisms for protective immunization and for the preparation of curative serum. South African M. J. **12**: 294-296, April 23, 1938.
30. PLUM, D.: Plague epidemic in Nairobi, with special reference to place incidence and treatment. East African M. J. **19**: 3-9, April 1942.
31. PHILLIPS, R. L. and BARNES, L. H.: Treatment of Pasteurella pestis infection in mice. J. Franklin Inst. **235**: 94-97, January 1943.
32. ROBIO, M.: Sérothérapie dans la peste pulmonaire primitive. Bull. Soc. path. exot. **30**: 204-208, 1937.
33. Serum treatment of human plague. Seventh Report on Plague Investigations in India, J. Hyg. **12**, Plague Supplement II, 326-339, 1912.
34. SAVINO, E. and MORALES VILLAZON, N.: Acción de la sulfanilamida y sus derivados en la peste experimental. Semana med. **2**: 297-300, August 6, 1942.

35. SCHUT, J.: Weitere Versuche mit Ommadin bei Lungenpest in dem Tengger (Java). Arch. f. Schiffs- u. Tropen-Hyg. 34: 223-227, April 1930; abstr., Trop. Dis. Bull. 27: 734, September 1930.
36. SCHUTZE, H.: The envelope antigen of *B. pestis* and its antibody. Brit. J. Exper. Path. 15: 200-206, August 1934; abstr., Trop. Dis. Bull. 31: 886-887, December 1934.
37. SCHUTZE, H.: Chemotherapy in plague infection. Lancet 1: 266-268, February 4, 1939.
38. SOKHEY, S. S.: Reports of the Haffkine Institute, Plague Department, 1932-35, 1936, 1938.
39. SOKHEY, S. S.: Experimental studies in plague; experimental animal of choice for plague work. Indian J. M. Research 27: 341-354, October 1939.
40. SOKHEY, S. S. and DIKSHIT, B. B.: Sulphathiazole in bubonic plague. Lancet 1: 1040-1042, June 8, 1940.
41. SOKHEY, S. S.: Un nouveau sérum antipestueux. Bull. Office internat. d'hyg. pub. 28: 1097-1100, June 1936.
42. SOKHEY, S. S. and WAGLE, P. M.: Report of the Haffkine Institute, Plague Department, 1940-41.
43. SOREL: Sur le comportement de l'endémie pesteuse dans les Colonies françaises, particulièrement au cours des deux dernières années. Bull. Office internat. d'hyg. pub. 29: 2071-2092, October 1937.
44. STICKER, G.: Abhandlungen aus der Seuchengeschichte und Seuchenlehre die Pest. Erster Teil: Geschichte der Pest. Band I. A. Topelmann, Glessen, 1908.
45. STRONG, R. P.: Studies in plague immunity. Philippine J. Sc. 2: 155-331, June 1907.
46. TOWNSEND, S. L.: Plague (bubonic and pneumonic) in Port Said. J. Roy. Nav. M. Serv. 30: 25-29, January 1944.
47. VINE, R. S.: Plague in Nilgiris. J. Roy. Army M. Corps 71: 382-395, December 1938.
48. de VILLAFANE LASTRA, T., GOOBAR, J. K., RODIERO, M. S. VIDELA: Tratamiento de la peste de Oriente. Congr. nac. sobre enferm. endemo-epidem., Buenos Aires 1: 586-593, Nov. 9-13, 1942; abstr., Trop. Dis. Bull. 41: 400, May 1944.
49. WAGLE, P. M., SOKHEY, S. S., DIKSHIT, B. B. GANAPATHI, K.: Chemotherapy in plague. Indian M. Gaz. 76: 29-32, January 1941.
50. WALKER, J. N. N.: Treatment of plague cases with convalescent human serum. Indian M. Gaz. 72: 469-473, August 1937.
51. WAYSON, N. E., and McMAHON, M. C.: Plague. Sulfadiazine treatment of guinea pigs infected by artificial methods or by flea transmission. Pub. Health Rep. 59: 385-401, March 24, 1944.
52. YERSIN, M. CALMETTE, and BORREL: Ann. Inst. Pasteur 9: 589, 1895.
53. Plague. War Department Technical Bulletin, TB MED 124. War Medicine 7: 40-43, January 1945.

ALCOHOL AS A FACTOR IN NAVAL DELINQUENCIES

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In dealing with the problem of delinquency in the naval service it might be expected from common experience that sooner or later the investigator will be confronted with the problem of alcohol. It is the purpose of this paper to present the findings of the psychiatric unit at a Naval Disciplinary Barracks regarding alcohol and its influence in the production of delinquent behavior.

In a group of 1,000 unselected admissions¹ to this activity of offenders against the Navy, 96 were found to have been due, in large part, to the intemperate use of alcohol. The offenses with which these men were charged are listed in table 1.

TABLE 1.—*Distribution of offenses*

Offense	Number	Offense	Number
Absence over leave and absence without leave.....	91	Shirking duty.....	1
Drunk and disorderly.....	1	Rape.....	1
Refusing to obey orders.....	1	Larceny.....	1

The ages of these men are given in table 2. The median age is 22.7 years, and the mean is 24.3. In the original group of 1,000 cases studied the median age was 19.6 and the mean 21.6 years. If one were to subtract the 96 cases under consideration from the 1,000 cases, the differences would be even more marked.

Inasmuch as the type of offense parallels that of the original group of 1,000 cases (94 percent absent over leave or absent without leave), it is interesting to compare the length of time spent absent over leave or absent without leave by the two groups. The 96 "alcohol" cases averaged 32.9 days of unauthorized absence as compared to 33.8 for

¹ LOCKE, B., CORNSWEET, A. C., BROMBERG, W., and APUZZO, A. A.: Study of 1,063 naval offenders. U. S. Nav. M. Bull. 44: 73-86, January 1945.

the total group. The medians were 14.2 days for the 96 cases and 16.23 for the 1,000 cases. Here again, if the 96 cases are subtracted from the total group, the difference becomes more marked, this time in favor of the "alcohol" group.

TABLE 2.—*Age of offenders*

Age	Number	Age	Number	Age	Number
17.....	5	27.....	2	37.....	1
18.....	7	28.....	2	38.....	2
19.....	10	29.....	0	39.....	1
20.....	12	30.....	4	40.....	0
21.....	8	31.....	1	41.....	0
22.....	10	32.....	2	42.....	0
23.....	6	33.....	1	43.....	0
24.....	5	34.....	3	44.....	2
25.....	4	35.....	1	45.....	1
26.....	5	36.....	1		

Table 3 presents the distribution of previous naval courts-martial for the 96 cases under consideration. This table indicates that 76.1 percent of these cases have had at least one previous court martial. This figure is considerably greater than the 53.8 percent found for the total group of 1,000 cases.

TABLE 3.—*Previous courts-martial*

Number	Cases	Number	Cases
0.....	23	4.....	8
1.....	28	5.....	3
2.....	28	6.....	1
3.....	5	Total.....	96

In the matter of civil offenses prior to entering the Navy the "alcohol" group again compares unfavorably with the total group of offenders. We found that 32.3 percent had been in conflict with the civil authorities as compared to 16.7 percent for the 1,000 cases. Here, as previously, if the 96 "alcohol" cases are subtracted from the findings in the total group, the difference becomes even more startling. The number of previous civil offenses is listed in table 4. The 10+ group includes one case with more than 35 arrests and another with over 50.

TABLE 4.—*Previous civil offenses*

Number	Cases	Number	Cases
0.....	65	7.....	0
1.....	12	8.....	0
2.....	8	9.....	0
3.....	6	10+.....	3
4.....	1	Total.....	96
5.....	1		
6.....	0		

In the matter of education and intelligence it was found the mean grade completed by the "alcohol" cases was 8.8 grades as compared to 9.3 grades for the total group. In the original group of 1,000 cases, 19 were diagnosed as having borderline or defective intelligence; 11 of these come from the ranks of the "alcohol" group. Table 5 indicates the school grades completed by these men.

TABLE 5.—*Academic grades completed*

Grades		Cases	Grades		Cases
4		1	10		16
5		3	11		11
6		7	12		10
7		20	13		2
8		15			
9		11	Total		96

When one considers the academic record of this group of offenders, one finds that in delinquencies in school it is slightly better than the total group. Of the "alcohol" group 38.5 percent were involved in academic delinquencies as compared to 42.3 percent for the nonalcohol group. Table 6 presents the findings for both groups. Figures in the column for the total group do not include those for the 96 "alcohol" cases.

TABLE 6.—*Number of academic delinquencies*

	Truancies		Expulsions				Suspensions			Admissions to truant schools
	Frequent	Occasional	1	2	3	4	1	2	3	
96-case group	17	10	5	1	0	0	0	0	1	3
1,000-case group (minus 96-case group)	122	171	44	6	6	2	13	5	3	11

Table 7 indicates the marital status of these men. From this we note that the incidence of the marital difficulties is more than 27 times as frequent in the "alcohol" group as in the total group studied since the 17 divorces or separations in the total group include the 12 in the "alcohol" group.

TABLE 7.—*Marital status*

	Single	Married	Divorced or separated
96-case group	63	21	12
1,000 case group	704	279	17

The psychiatric findings show definite differences between the "alcohol" group and the other disciplinary cases. Table 8 lists the psychiatric diagnoses for the "alcohol" group and for the 1,000 cases studied. From the latter group we have subtracted the 96 cases that make up the "alcohol" group and we note that 69.8 percent of the "alcohol" group have had some positive psychiatric diagnosis made as compared to 16.8 percent for the other offenders.

TABLE 8.—*Psychiatric findings*

Diagnosis	96-case group	1,000-case group (minus 96-case group)
No disease	29	752
Psychopathic personality	21	61
Mental deficiency (including borderline intelligence)	11	8
Psychoneurosis	5	67
Chronic alcoholism	29	0
Neurological disorders	1	11
Psychoses	0	5
Total	96	904

In 3 of the 96 cases examined there was a history of occasional use of narcotics; marihuana (2 cases), and morphine, (1 case), but in none of these was there any indication of true drug addiction.

Examining the family history of these cases reveals a striking frequency of neuropathic factors. These were present in 33 of the cases, and the factors noted are presented in table 9.

TABLE 9.—*Neuropathy in family*

"Nervousness" including "nervous breakdowns"	16	Tuberculosis	3
Alcoholism	15	Epilepsy	2
Separation or divorce	6	Psychoses	2
		Paralyses	2

The racial distribution of this group was also studied. There were 87 white men (90.7 percent) and 9 Negroes (9.3 percent) in the "alcohol" group as compared to 834 white men (91.9 percent) and 70 Negroes (8.1 percent) in the other group of offenders.

In addition to the differences between the alcoholic and nonalcoholic offenders which we have noted, we found that our alcoholic offenders fell into three primary clinical groups. These were: (1) The older chronic alcoholic; (2) the neurotic and psychopathic individual who had begun to use alcohol as a cover for the anxieties and fears which had been aggravated by the stress of war; and (3) the youngster who was under the impression that he could demonstrate his "manhood" to his shipmates and the "girls," through the consumption of prodigious quantities of beer and whisky. With the first group and a portion

of the second, the Navy, particularly in wartime, can do very little. The remainder, however, presents a distinct challenge to the psychiatric services and the retraining commands of the naval disciplinary organizations.

Three brief case reports on excessive users of alcohol which indicate typical problems that are met frequently are presented next.

Case 1.—A 45-year-old ship's cook of Irish-American parentage was admitted to this institution for trial by summary court martial for 16 days' absence over leave. His prior record included 4 summary courts-martial, 1 deck court, and 3 captain's masts for absence over leave and absence without leave.

He admitted to excessive ethylism for the past 30 years—his average consumption being a quart of whiskey daily. He gave a history of 3 civil arrests for being drunk and disorderly and for panhandling. His major employment had been that of a cook but he never held a job for more than a few months at a time. He had been married and divorced twice and admitted that his drinking was a major factor in bringing about his divorces. He gave a further history of at least one hospital admission because of the "D. T's" and of one convulsion following an alcoholic bout.

Family history revealed that subject's father died following a series of convulsions brought about by excessive use of alcohol. The mother was described as being mentally unstable.

Examination revealed numerous signs of a long-standing overindulgence in alcohol. There was a fine tremor of the head, tremors about the mouth, and of the extended fingers and tongue. There was a polyneuritis and diminution of the ankle jerks. There were oculomotor changes present. Subject reported frequency and urgency of urination. Some mental changes were noted, particularly in the area of memory. Because of the findings this man was recommended for discharge from the naval service.

Case 2.—A 32-year-old white male was admitted for trial by general court martial for 165 days' absence without leave. He complained of having spells in which he became very anxious and thought of suicide. He grinds his teeth and has to restrain himself from jumping off a height. These spells occur at night more than in the daytime. During the former he shouts and screams and bangs the wall and talks in his sleep. Subject further reported that while working in an outlying base with the United States Army he was discharged because "I went out of my mind". He has been drinking heavily since the onset of his difficulties. Mental examination revealed a depressed expression with anxiety and some degree of over acting. His description of feelings of being followed was obviously simulated. Episodes of anxiety at night were apparently valid. His reactions, attitude, and course of life all indicated a psychopathic individual who was using alcohol to excess.

Case 3.—A 17-year-old boy of American parents. He was admitted to this activity for trial by general court martial for 41 days' absence over leave. He had had 2 previous summary courts-martial for absence over leave.

He completed the seventh grade in school at the age of 15 years and did unskilled or semiskilled work until entering the Navy as a volunteer on March 22, 1943. Medical history was essentially negative.

Psychiatric examination revealed an immature, belligerent youth. There was a great deal of resentment expressed against his stepmother who had placed him in an orphanage upon his father's death, for 4 years. "If she had just waited a little while it wouldn't have been so obvious that she wanted to get rid of us." Some of this resentment carried over to the Navy because he couldn't have

his own way. He requested foreign shore duty and couldn't get it so he started his absences over leave. He began drinking to excess and got drunk "every chance I had." It was felt that his toughness was a veneer to cover his feelings of inadequacy and frustration and this was later borne out by his own request to return to duty.

SUMMARY

In a group of 1,000 unselected admissions to a naval disciplinary barracks, 96 were found to have been due in large part to excessive alcoholism. These 96 cases were compared against the nonalcohol cases with the following findings:

1. The type of offenses for which they were incarcerated parallels that of the nonalcohol group (94 percent absent over or without leave).
2. The alcohol group was about 3 years older than the nonalcohol group as an average.
3. The length of time absent over or without leave averaged a few days less than the nonalcohol group.
4. The alcohol group included 76.1 percent of previous offenders as compared to 53.8 percent for the nonalcohol group.
5. There were about twice as many men with records of civil arrests among the alcohol group as in the nonalcohol group (32.3 and 16.7 percent respectively).
6. The alcohol group completed 8.8 grades of school as compared to 9.3 grades for the total group. Eleven of the cases were diagnosed as having borderline or defective intelligence as compared to 8 for the total group (11.5 percent as contrasted to 0.9 percent).
7. The alcohol group was found to compare favorably with the nonalcohol group in the matter of academic delinquencies (38.5 percent of the group as compared to 42.3 percent involved in academic difficulties).
8. Marital difficulties (divorces and separations) were 27 times as frequent among the "alcohol" offenders. There were 12 divorces or separations among these men as compared to 5 for the 904 nonalcohol men.
9. Positive psychiatric findings were made in 69.8 percent of the alcohol group as contrasted to 16.8 percent for the other offenders.
10. Neuropathic factors were found in the family histories of 33 of the alcohol group.
11. As in the group of nonalcohol offenders, Negroes were found to occur more frequently in the alcohol group than their incidence in the Navy would indicate (9.3 percent of the alcohol group were Negroes).
12. Three clinical types were demonstrated by case histories.

A TREATMENT FOR OTITIS EXTERNA IN THE TROPICS

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In tropical areas otitis externa, better known as fungus of the ears, is a most distressing and ubiquitous disease. Due to the fact that the precipitating etiological factors are primarily climatic, the medical officer is often sorely tried to effect a cure for the various manifestations of the disease and to hold it in check among his personnel. Culminating observations made aboard various ships and on many south Pacific islands, the use of a mixture of penicillin, sulfathiazole, and boric acid powders has been satisfactory in curing many cases and in preventing recurrences of otitis externa.

The preparation of the powder is very simple. Equal parts of sulfathiazole and boric acid powders are mixed together and enough penicillin powder is added to give the completed mixture a light yellow color. This powder is placed in a powder blower and kept in the refrigerator ready for use at all times. It has been convenient to call this mixture the "psb" powder.

The first step in the treatment of otitis externa consists of cleansing the affected ear of all exudate, cerumen, and other detritus. Several methods of cleansing the auditory canal are feasible. If the meatus is not markedly constricted, the use of the standard metal ear syringe for irrigation is safe and simple. An antiseptic solution for the irrigation can be prepared quickly and simply by blowing a few squirts of the "psb" powder into a pan of warm water and then stirring the concoction with the syringe. If the meatus is markedly constricted, the canal often can be cleansed by "bubbling it out" with hydrogen peroxide and then removing the residual detritus by means of a cotton-tipped probe. Reduction of the inflammatory swelling about the canal can often be enhanced by instilling a hygroscopic solution of penicillin in glycerin and then placing a cotton pledget in the canal to retain the solution. If the meatus of the auditory canal is entirely closed, no attempt to cleanse or irrigate the canal should be made.

After the canal is cleansed of detritus, it is carefully dried with cotton-tipped applicators. Since the walls of the canal are usually macerated and friable, care should be taken to avoid traumatizing the tissues and causing bleeding.

The final procedure consists of blowing enough of the "psb" powder into the clean dry canal to form a thin coating over all surfaces and on the tympanic membrane. With a little practice the medical officer can secure an even distribution of the powder without causing it to pile up against the tympanic membrane.

The process of cleansing, drying, and blowing powder into the external auditory canal is repeated daily until the inflammatory condition is substantially reduced. The treatments are then repeated as often as necessary to keep a thin coating of "psb" powder within the canal. Even after all inflammation has apparently disappeared, it is advisable to have the patient return four or five times at weekly intervals to have his ears checked and the coating of powder reapplied.

The formula for the "psb" powder was arrived at empirically. An attempt to use penicillin powder alone was unsuccessful because of its deliquescent properties. A mixture of penicillin and sulfathiazole powders was also found to be moderately deliquescent in the Tropics, and it tended to leave hard encrusted particles of sulfathiazole when placed in the auditory canal. In a temperate climate, however, the penicillin-sulfathiazole combination can be kept dry for a considerable period of time.

After its value in otitis externa was established, the "psb" powder was used in cases of acute tonsillitis, septic sore throat, and Vincent's angina with apparent good results. Also a penicillin and sulfathiazole powder mixture has proved very efficacious in the treatment of lacerated wounds, contaminated surgical wounds, and in many cases of acute conjunctivitis where boric acid powder would be too abrasive. The use of these powder mixtures in powder blowers insures their ready availability at all times and simplifies the process of applying the powders.

COLLOID MUCOSTATIC IMPRESSION TECHNIQUE FOR FULL LOWER DEN- TURES

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Out of deference to other men in the profession this is not new technique but one designed to reach the average dentist, that dentist who probably does not construct many lower dentures in a year's time but who is interested in giving his patient the best service available.

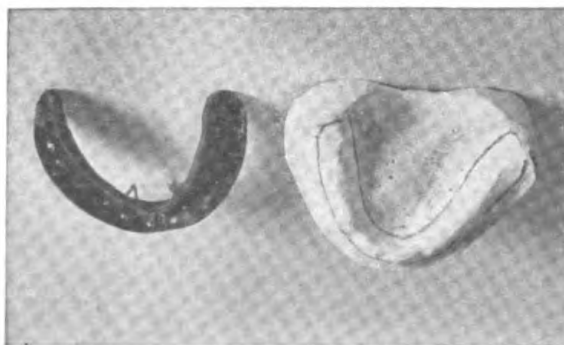
MATERIALS AND TECHNIQUE

Several colloid materials have been used in running these tests. The choice rests, to a great extent, upon the one with which the operator is most familiar. Coe-Loid, as supplied by the Medical Department of the Navy,¹ has become our choice, although there are undoubtedly several others on the market which possess equal merit.

The success or failure of the technique depends upon a perfect impression, or the closest approach to one with the materials now available, that is possible. It is a simple technique but not a careless one, and is performed under conditions which are most exacting.

The steps in the technique must be followed to the letter; err in

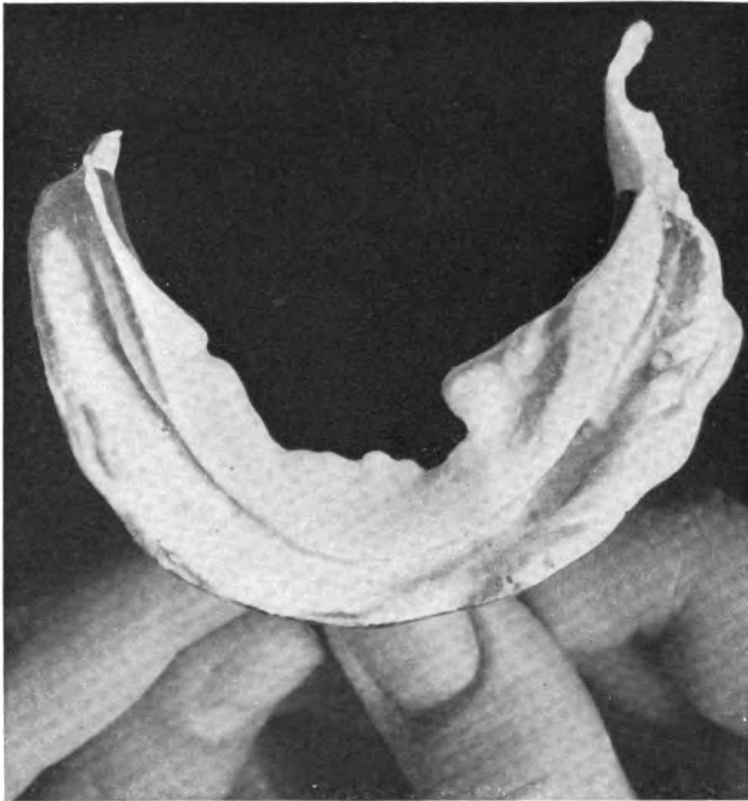
one step and it fails to achieve its purpose, suction. The steps to follow in the procedure will be given in sequence, and the impression material used is Coe-Loid. The amount of water used will be 70 cc. instead of 55 cc.



1. Snap impression model, and Coe-Loid impression tray made thereon from Kerr base-plate compound.

1. Take a snap impression with Kerr's impression compound and pour in plaster.

¹ See Catalog of Navy Material, Bureau of Medicine and Surgery Section, Stock No. 5-362-500.

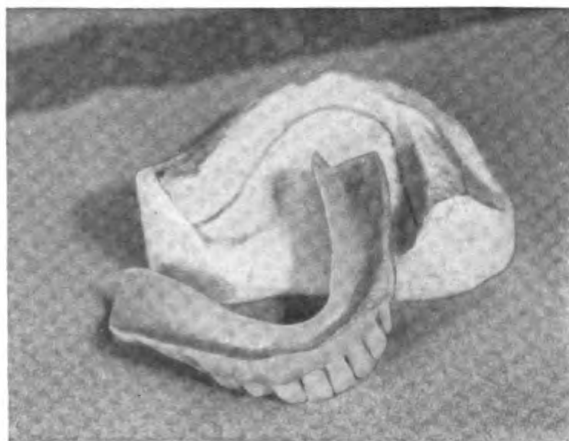


2. Impression as taken in Coe-Loid. Note absence of muscle trim, etc.

2. Outline a *narrow* tray in pencil on the model, keeping well above any muscle attachments. Be sure to include the retromolar pad. Over-extension of any type involving muscle attachments is definitely contraindicated. If in doubt, grossly under-extend.

3. Construct Kerr base-plate tray, double thickness, along pencil line. Attach handle of wire with sticky wax. The tray is liberally perforated with a large rose bur to hold the mix upon setting. That supplies the tray. Next comes the preparation of the patient.

4. Have patient rinse mouth two or three times (2 minutes inclusive) with a strong antiseptic and astringent solution to remove mucuous plaques, etc.



3. Completed case and snap impression model for constructing impression tray.

5. Wipe the ridge with gauze to insure dryness, for dryness is imperative. (A wet-mouthed patient should be given an injection of $\frac{1}{300}$ grain of atropine sulfate intramuscularly or subcutaneously one-half hour prior to impression). Now pack the mouth with gauze.

6. As the packing starts, the assistant should begin mixing the impression material, 70 cc. of water per tube of powder. Mix 1 minute.

7. Place impression material in tray. It will be slightly runny, but that may be disregarded.

8. Rapidly remove the gauze from the patient's mouth and immediately insert tray. At this point caution patient not to close and swallow. *Use no pressure to seat tray*, merely rest tips of the fingers on the tray to stabilize it. Let the material flow of its own accord.

9. The patient's mouth is to be kept quite still. There must be no effort on either his or the operator's part toward muscle trimming.

10. Remove the impression upon its setting. Let us say here that it probably will be the worst looking example of an impression that it is one's misfortune to observe, judged by prevailing and accepted standards. Disregard that. But, and it's a big *but*, if the base plate shows through the impression material, remove the latter and take another impression. Pressure has been used and only moderate suction on the finished denture would be achieved.

11. Pour the impression in thick stone and outline the periphery of the denture in indelible pencil, which will appear on the eventual acrylic denture. Keep the outline *well above muscle attachments*.

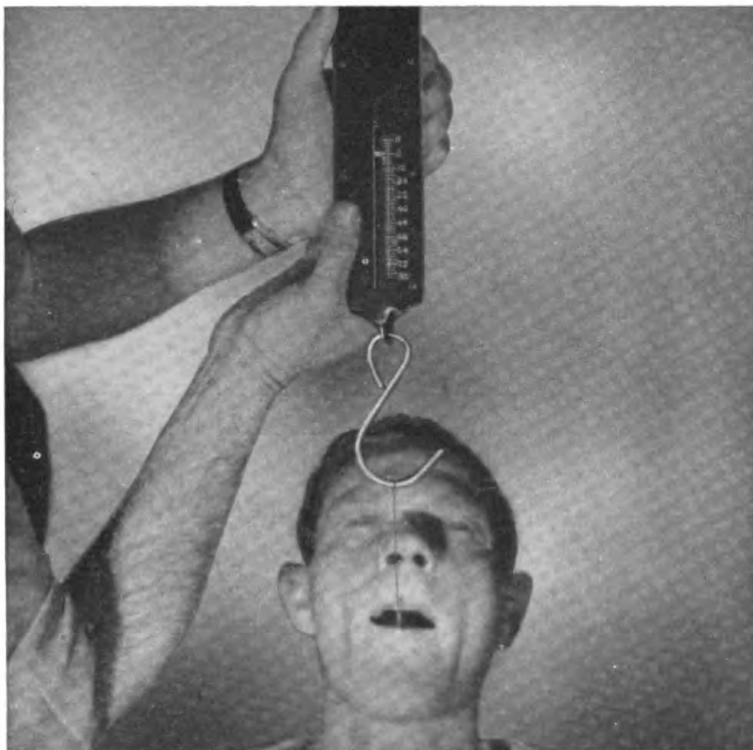
12. The denture must be completely finished to a *razor edge* along this line.

13. There must be no polishing of that portion of the denture contacting the ridge.

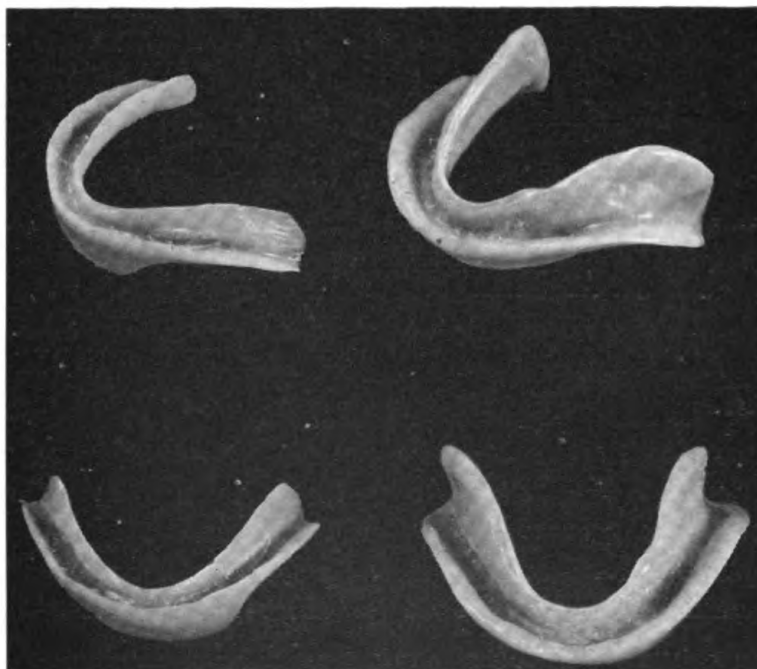
14. After packing, the acrylic must be given a slow cure, i. e., 6 hours in water of 160° F., then slowly cooled. Otherwise, warpage and distortion will result in an ill-fitting case. This is true with any acrylic.

By the foregoing technique the finished denture is produced. Suction appears from immediately to within 2 hours. Figure 4 indicates the amount of pounds of direct pull needed to produce displacement. Sore spots are rare along the razor edge or elsewhere.

Although the whole procedure is diametrically opposed to established custom in impression taking and the completed structure might be described as a "Gay 90's Model," it works, and that is the criterion.



4. Amount of pounds of direct pull needed to produce displacement. Scale is accurate to one-half pound. Actually $7\frac{1}{2}$ -pound pull.



5. Small, mucostatic duplicate base, opposed to bulky lingual locked and overextended "old type" denture from which the teeth have been removed. The former produced the described results; the latter had always been an abysmal failure. Note the apparently "rough" surfaces on mucostatic base.

ENDOGENOUS VERSUS EXOGENOUS ORIGIN OF REINFECTION TYPE PULMONARY TUBERCULOSIS

With Case Report

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In a recent editorial in the UNITED STATES NAVAL MEDICAL BULLETIN (1), it was stated that a rise in the incidence of tuberculosis in the Navy should be anticipated as a result of the establishment of the extensive case-finding program now in effect. In naval medicine, the consideration of endogenous versus exogenous origin of reinfection-type tuberculosis may be of additional value by way of eventual influence on the decision as to whether the active disease "existed prior to entry" or prior to an advancement in rank or rate. Thus any data pertinent to this important and extant disease become significant.

In view of Jaffe's statement (2) that "there are only very few observations on record in which the exacerbation of an old pulmonary primary lesion could be definitely proved," the case herein reported was considered of interest.

GENERAL DATA

(A) Definitions

The term "reinfection tuberculosis" refers, of course, to that form of the disease which occurs after a primary lesion has been sustained. It has also been termed "adult type tuberculosis," "secondary infection," and "super-infection." It is well known that the pathologic changes of the first (primary) infection and of the reinfection are as different as though they were two separate diseases, probably because of influence of the Koch phenomenon. As applied to reinfection tuberculosis, "endogenous origin" indicates that the bacilli causing the disease process have been derived from an old primary infection, and "exogenous origin" implies that the causative organisms have come from an outside source. In amplification of the latter, Jaffe states that in an exogenous superinfection (reinfection) the bacilli from the outside source may either get a direct foothold or they may undergo disintegration, liberating a tuberculin-like substance which in turn "activates" an old infection (primary).

(B) Incidence

(1) *Latent first infection*.—Carnes (3), in a study of latent lesions in urban dwellers in 536 autopsies, concluded that (considering age distribution of the population) about 90 percent of all adults have been infected with tubercle bacilli. Jaffee states that 70 to 80 percent of autopsies reveal a pulmonary primary lesion. However, it is important to note that bacteriologic surveys of such lesions are usually marked by the absence of virulent bacilli (4) (5) (6). Also, in a histological study on a great number of old primary lesions, Jaffe has been unable to record a single instance in which the reparative granulation tissue revealed specific changes, thus indicating that no viable tubercle bacilli were present in the centers of old tubercle formations.

(2) *Clinically manifest reinfection*.—According to Moore (4) and from the studies of Opie (7), in almost every case of clinically manifest reinfection pulmonary tuberculosis, the calcified nodules of a first (primary) infection can be identified.

(3) *Latent reinfection*.—Anatomic study of persons who die of causes other than tuberculosis reveals a high incidence of lesions believed to be caused by the tubercle bacillus (8). The characteristic lesion is the "apical scar" just inferior and posterior to the extreme apex. Moore found such apical scars in 33 percent of lungs of white persons (St. Louis, 1941). These cases constitute latent reinfection pulmonary tuberculosis. In contrast to primary lesions, injection of these apical scars" into guinea pigs causes tuberculosis in 75 percent (6) (9), thus establishing both the tuberculous nature of the condition and the presence of viable and virulent bacilli.

(C) Exogenous Versus Endogenous Route of Reinfection

While both of these possibilities probably do occur, the exogenous route appears to be of greater frequency and greater importance than the endogenous route (2). When exacerbation of the lymph-node component of the primary complex does occur, as noted by Ghon and others, it seems that extrapulmonary metastases follow more frequently than does pulmonary tuberculosis (2). That the exogenous route is the usual and more important one is concisely and clearly presented by Moore. The evidence, as given by him, is as follows:

(1) *Bacteriologic*.—It is *not* usually possible to demonstrate bacilli in first infection lesions, as noted before (4) (5) (6). If the bacilli were disseminated from these lesions to the apex of the lung to produce an endogenous exacerbation, infectious lesions of some sort should be demonstrable, but they are *not*.

(2) *Anatomic*.—Careful study of the latent calcified nodules and the latent apical lesions *fails* to reveal any continuity between the two, as is usually the case in related tuberculous lesions. Also, histologic

study of the earliest apical lesion shows an essentially aerogenous infection with the initial reaction in the smaller respiratory bronchioles.

(3) *Epidemiologic*.—If reinfection is exogenous, it is reasonable to believe that latent and manifest apical lesions would be present more frequently in those exposed to tuberculous patients with positive sputa than in the general population. That such is actually the case has been proved by the studies of Opie, McPhedran, and Putnam (10), Opie and McPhedran (11), Hahn, et al. (12), and Hahn (13). These studies include families, marital partners, attendants in sanatoria, and medical students.

A replete discussion of exogenous and endogenous reinfection or reanimation of primary foci together with relative literature has been compiled by Rich (14).

REPORT OF CASE

The patient, a 29-year-old white male, was admitted to the sick list on 13 September 1944, following an x-ray of the chest taken on 10 September 1944, because of a persistent cough. The cough had its onset with an acute illness in May 1944, which was considered to be primary atypical pneumonia, though no facilities for a chest film were at hand at that time. This subsided clinically within 3 weeks and the patient returned to duty. However, a slight cough (non-productive) persisted. A weight loss of about 10 or 12 pounds was sustained following the onset of the acute illness, but 5 or 6 pounds of this had been regained by September 1944. The patient had moderate night sweats, but had not taken notice of this because of the hot climate in which he was stationed. There was no malaise. No symptoms referable to other systems were present.

The patient had always enjoyed excellent health and no episodes suggestive of previous pulmonary disease had been experienced. However, a Mantoux test, done as a routine procedure, was positive in 1938. Also, a chest film (again a routine procedure and not done because of any symptoms) in 1940 showed apparently a calcified component of a primary complex in the left hilar zone (fig. 1). There was no familial history of tuberculosis. The patient had no contact with any known case of tuberculosis for at least 3 years prior to admission to the sick list. None of his shipmates, among whom he had lived for the previous 22 months, had evidence of pulmonary tuberculosis, as indicated by photofluoroscopic survey of officers and crew in September 1944. On examination, the patient was a well-developed, well-nourished white male, who did not appear ill. No pertinent abnormalities were noted other than highly questionable fine râles at the level of the left fourth rib anteriorly.

Laboratory and x-ray findings.—On admission to the sick list (13 September 1944), blood picture (RBC, WBC, total and differential) was within normal limits. Sedimentation rate was 12 mm. in 1 hour. X-ray of the chest (fig. 2) showed an infiltrative shadow in the left lung extending from the hilus towards the periphery between about the second interspace and the fifth rib. The apparently calcified hilar lesion (noted in 1940, fig. 1) was no longer present. Stereoscopic views did not aid in revealing any areas suspicious of cavitation.

Sputum examinations done daily for about 2 weeks were persistently negative for tubercle bacilli.

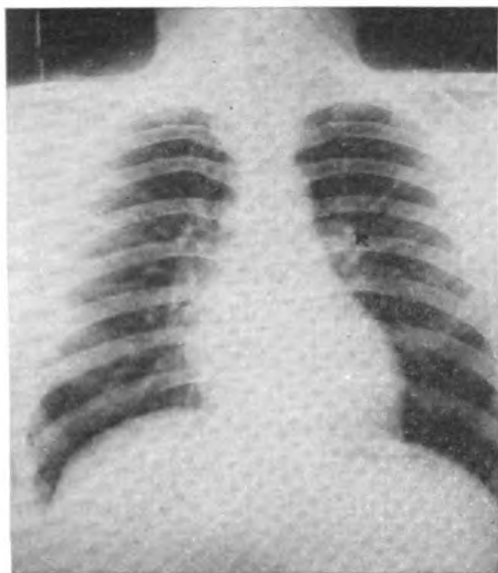


FIGURE 1.—X-ray of chest in July 1940. Arrow indicates dense (calcific) shadow, considered to be a component of primary complex in left hilar zone (at upper border of fourth costochondral junction). Periphery and apices of lungs are clear.

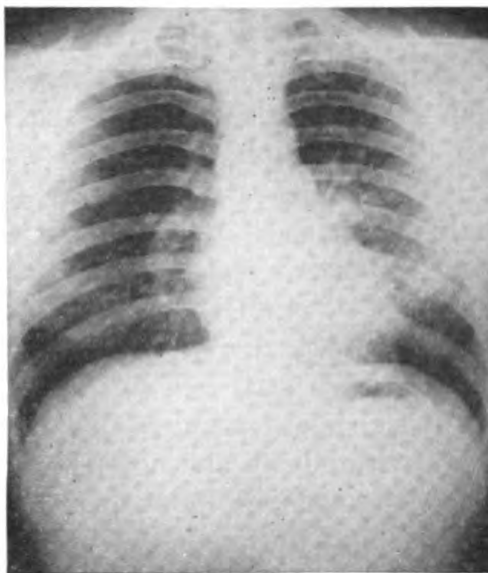


FIGURE 2.—X-ray of chest in September 1944. Infiltrative shadow in left lung extending from hilus towards the periphery between the second and fifth interspaces. The apparently calcific hilar shadow noted in figure 1 (at upper border of fourth costochondral junction) is no longer seen, but appears to have given way to a softer, more diffuse shadow suggestive of "break-down" of the primary lesion.

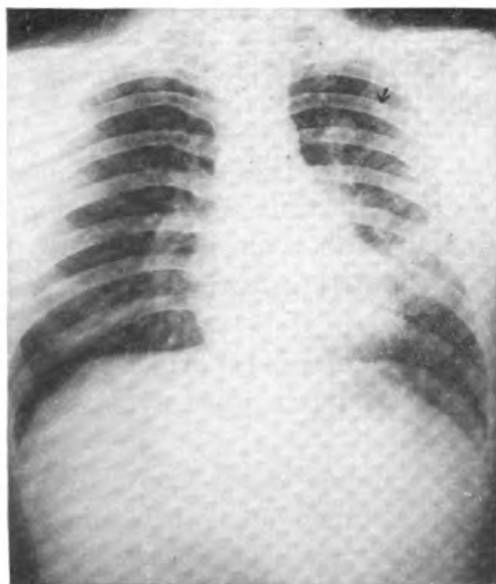


FIGURE 3.—X-ray of chest in November 1944. Infiltration of left lung from second to fifth interspace, with cavity (1 cm.) at lower border of second rib (as indicated by arrow). Further diffusion of shadow at left hilar region.

Course.—The patient was put to bed for observation. There was usually a slight afternoon rise of temperature to 99° or 99.2° F. Weekly chest films showed some clearing of the infiltrative shadow; however, an increasingly distinct ring shadow made its appearance at the lower border of the left second rib, being easily identifiable by 1 November 1944 (fig. 3). That this was a cavity (one cm. in diameter) was confirmed by planographic examination. On 4 November 1944, examination of sputum was reported positive for acid-fast bacilli and confirmed by subsequent examinations. Guinea-pig inoculation with a sputum specimen (begun on 1 October 1944) was reported positive on about 6 November 1944.

COMMENTS

From the chest films of figures 1 and 2, it is suggested that the plainly visible calcific hilar lesion of figure 1 broke down and allowed a spilling of viable bacilli, which in turn gave rise to the reinfection-type tuberculosis with cavitation as seen in figures 2 and 3. It is realized that such evidence does not constitute definite proof. However, the added feature of no likely outside contacts makes the explanation of endogenous origin in this case more plausible. There seems but little doubt that the old lesion of the primary infection in this case was activated by the acute pulmonary infection, i. e., the possible primary atypical pneumonia. The diffuse interstitial pathology with edema and accompanying parenchymal injury as seen in atypical pneumonia does form a likely exciting factor. It is known that atypical pneumonia often simulates pulmonary tuberculosis both clinically and roentgenographically as has been stressed by Yoskalka (15). It is quite possible, however, that the initial acute illness in this case was tuberculosis. In the case herein presented, a period of 4½ months elapsed between the acute disease and the last admission to the sick list; during that period, the patient gave no definite evidence of illness. While it may seem unlikely that the acute episode with febrile reaction as high as 102° F. obligating bed rest would have subsided within 3 weeks had it been of tuberculous nature, such is quite possible and does occur, as pointed out by Pinner (16).

SUMMARY

1. A brief review of the literature indicates that the exogenous route is generally considered much more important than the endogenous in the origin of reinfection pulmonary tuberculosis.
2. General data as to incidence of latent first infection and latent reinfection are presented.
3. A case of reinfection pulmonary tuberculosis is reported wherein x-ray evidence and lack of outside contacts suggest quite strongly an endogenous origin.
4. The role of atypical pneumonia as a factor in the excitation of latent primary lesions with resultant endogenous reinfection is emphasized.

REFERENCES

1. Editorial: Tuberculosis in the Navy. U. S. Nav. M. Bull. 44: 639-640, Mar. 1945.
2. JAFFE, R. H.: Pathology of pulmonary tuberculosis, in GOLDBERG, B.: Clinical Tuberculosis. F. A. Davis Co., Philadelphia, 1944. Vol. I, chapter 4.
3. CARNES, W. H.: Present incidence of tuberculous infection. Bull. Johns Hopkins Hosp. 70: 101-123, Feb. 1942.

4. MOORE, R. A.: Textbook of Pathology. W. B. Saunders Co., Philadelphia, 1944. pp. 295-310.
5. FELDMAN, W. H., and HELMHOLZ, H. F.: The presence of viable tubercle bacilli in lesions of the Ghon complex of children. *Am. J. Path.* 16: 679-681, Sept. 1940 (abst.).
6. OPIE, E. L. and ARONSON, J. D.: Tubercle bacilli in latent tuberculous lesions and in lung tissue without tuberculous lesions. *Arch. Path. & Lab. Med.* 4: 1-21, July 1927.
7. OPIE, E. L.: Pathological evidence of first infection in association with active pulmonary tuberculosis. *Am. Rev. Tuberc.* 10: 249-264, Nov. 1924.
8. SWEANY, H. C., LEVINSON, S. A., and STADNICHENKO, A. M. S.: Tuberculous infection in people dying of causes other than tuberculosis. *Am. Rev. Tuberc.* 48: 131-173, Sept. 1943.
9. BUNTING, C. H.: Pulmonary apical scar—inquiry. *Arch. Path.* 34: 67-72, July 1942.
10. OPIE, E. L., MCPHEDRAN, F. M., and PUTNAM, P.: Fate of persons in contact with tuberculosis; exogenous infection of children and adults. *Am. J. Hyg.* 22: 644-682, Nov. 1935.
11. OPIE, E. L. and MCPHEDRAN, F. M.: Exogenous tuberculous infection of adults; marital tuberculosis, *Arch. Int. Med.* 50: 945-951, Dec. 1932.
12. HAHN, R. G., MUSCHENHEIM, C., and FREUND, J.: Pulmonary tuberculosis in medical students and nurses. *Am. Rev. Tuberc.* 43: 600-611, May 1941.
13. HAHN, R. G.: Tuberculosis in the household; its occurrence in marital partners and other members of household when primary case was a parent or another member of family. *Am. Rev. Tuberc.* 47: 316-324, Mar. 1943.
14. RICH, A. R.: Pathogenesis of Tuberculosis. Charles C Thomas, Springfield, Ill., 1944. pp. 779-796.
15. YOSKALKA, J. S.: Atypical pneumonia simulating pulmonary tuberculosis. *Am. Rev. Tuberc.* 49: 408-413, May 1944.
16. PINNER, M.: Pulmonary Tuberculosis in the Adult. Charles C Thomas, Springfield, Ill., 1945.

CAPILLARY FRAGILITY IN RHEUMATIC FEVER

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Rheumatic fever is known to affect blood vessels but is not generally recognized as a vascular disease. Clinical findings in rheumatic fever include the vascular ones of epistaxis, purpura, and various erythematata. At post mortem in the acute stage of rheumatic fever, inflammatory changes in many arteries were found when they were searched for. According to Karsner, the synovial membranes in inflamed joints show hyperemia and edema and sometimes petechiae. However, all the vascular changes mentioned are customarily considered to be odd findings rather than to be the disease process itself. Too much attention is called to the cardiac pathology and one forgets that the heart is only highly specialized vascular tissue. The chief manifestations of rheumatic fever may be predominantly vascular.

The present study throws no light on the cause of rheumatic fever. It does intend to demonstrate that the minute vessels in convalescent rheumatic fever are generally damaged, as evidenced by their increased permeability to red cells. The term capillary fragility will be used instead of the more accurate but cumbersome term "minute vessel permeability to red cells."

METHOD OF STUDY

Capillary fragility was measured by applying pressure to the upper arm by means of a blood-pressure cuff and noting the time (number of minutes) in which numerous petechiae appeared distal to the cuff. Pressure of 100 millimeters of mercury was used in all cases. If only several scattered petechiae appeared, they were disregarded because an occasional weakened capillary does not indicate generalized capillary disease.

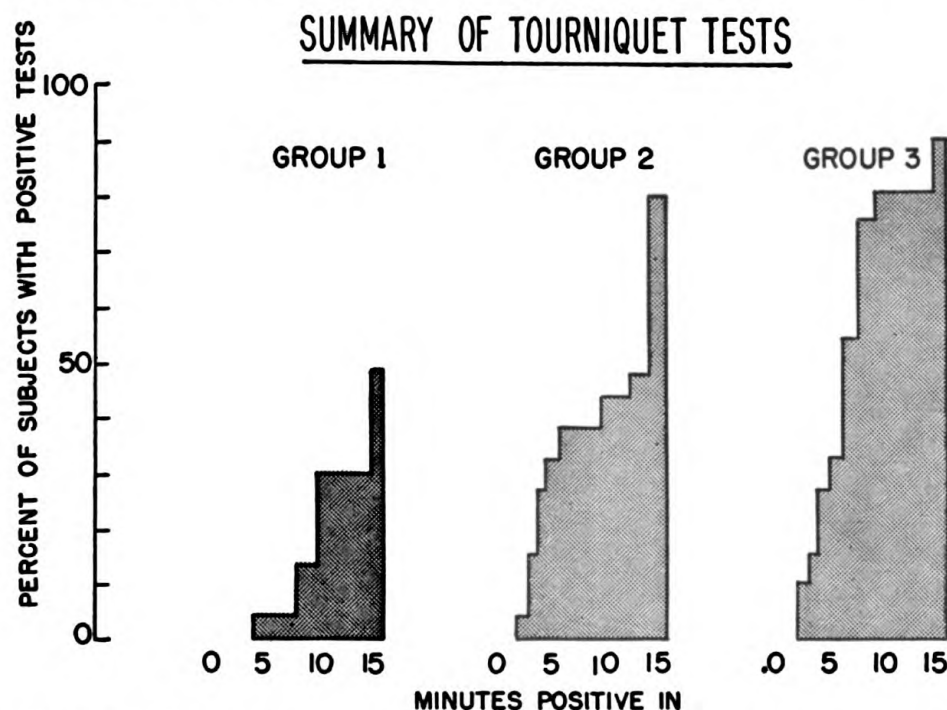
At first, area counts of petechiae were made, but this was abandoned because the size as well as the number of petechiae have significance, and the observer's impression of unmistakable petechiae served as the most satisfactory evidence of fragility. Cuff pressure was maintained only for the length of time required to produce petechiae. If petechiae failed to appear within 15 minutes, cuff pressure was released, observations discontinued and the result recorded as "nega-

tive." The method produces weak "positives" in about half the normal subjects studied, and so constitutes a sensitive test for the study of minor abnormalities in capillary fragility. Positives were recorded in minutes, the number of minutes to produce petechiae. Consequently, low values, below 8 minutes, indicate markedly increased fragility.

MATERIAL

Three groups of subjects were studied: (1) Controls, none of whom had fever when they were studied. The controls were equally divided between well individuals and patients who had diseases in which capillary fragility is expected to be normal. All three groups were service personnel, of average service age. A few in each group were women; (2) Convalescent rheumatic fever patients who had passed through at least the first several weeks of active rheumatic fever; and (3) Similar convalescent rheumatic fever patients with spontaneous purpura.

Group 1.—Twenty-five subjects were used as controls. Twelve of these had no disease. Of these, six had negative tourniquet tests; six were positive—three in 15 minutes, 2 in 10, and 1 in 4. Thirteen had diseases in which increased capillary fragility is not expected. Seven of these had negative tourniquet tests; six positive in from 8 to 15 minutes. It summarizes the controls to say that approximately one-half of them had positive tourniquet tests with the average value of 11 minutes for those positive.



Group 1: Controls (no rheumatic fever) 25 cases. Group 2: Rheumatic fever without purpura, 27 cases. Group 3: Rheumatic fever with purpura, 19 cases.

Group 2.—Twenty-seven patients convalescing from rheumatic fever had no spontaneous purpura and no history of it. Eleven had sedimentation rates above 10 mm. per hour, ranging from 12 to 23 (Cutler method). All but one of these had positive tourniquet tests. Average of the positive was 9 minutes. Nine had sedimentation rates below 10 mm., ranging from 1 to 8. Six of these had positive tourniquet tests. Average of the positives was 11 minutes. Of seven patients with no recorded sedimentation rate, five were positive in from 4 to 15 minutes, and two negative. In summary of the rheumatic fever group without purpura, 80 percent had positive tourniquet tests. Average of all positives was 10 minutes.

Group 3.—Nineteen patients convalescing from rheumatic fever had spontaneous purpura at the time when capillary fragility was measured, or within 3 weeks of that time. Tourniquet tests were positive in 17 or 90 percent. The average of all positives was 7 minutes. The vessels of this group had the greatest fragility, those of the rheumatic fever group without spontaneous purpura the next, and those of the controls least (see chart).

Platelet counts were made on five patients in the group with spontaneous purpura. The counts varied from 145,000 to 416,000 per mm. Bleeding time and clotting time were taken in seven. The bleeding time varied from 3 to 5 minutes, clotting time from 1.5 to 6 minutes (capillary method). The prothrombin time, by the Quick method, was normal in all five patients.

Six patients with rheumatic fever had markedly abnormal capillary fragility. Most had spontaneous purpura. They were treated with hesperidin, "vitamin P", with the hope that it might decrease their spontaneous purpura or lessen their increased capillary fragility. One-half gram of hesperidin was administered orally three times a day for from 10 to 14 days. Capillary fragility was measured before, during, and after the period of medication. In all, 53 measurements of capillary fragility were made. No decrease in spontaneous purpura or in measured capillary fragility resulted.

SUMMARY

Capillary fragility was significantly increased in a group of patients having rheumatic fever, and conspicuously increased in a group of patients having rheumatic fever and spontaneous purpura. This is further evidence that rheumatic fever is a disease of blood vessels.

PENICILLIN PROPHYLAXIS AGAINST ACUTE OTITIS MEDIA IN SCARLET FEVER

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and

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Scarlet fever is an infection of the tonsillo-pharyngeal area by various strains of beta-hemolytic streptococci, accompanied by a characteristic rash which may be considered an allergic skin manifestation. After the original toxic febrile period the seriousness of the disease is reflected in various complications due either to the bacterial toxins, to the causative organism, or to secondary invaders. Complications may result from local extension of the organisms from the throat into contiguous structures, such as the nasal accessory sinuses and the middle ear, or systemic progress by the hematogenous route to remote organs.

In the winter and spring of 1944-45 a moderately severe epidemic was encountered at a large naval training station. The necessity of expediting the return of patients to active duty prompted energetic measures to prevent extended hospitalization due to complications.

This paper is concerned with the comparative efficiency of penicillin and sulfadiazine therapy in the prevention of acute suppurative otitis media in scarlet fever.

Two hundred thirty-nine cases of scarlet fever were observed in the period between 10 December 1944 and 19 May 1945. These cases were divided into three groups as follows:

Group 1 (36 cases).—Received no prophylactic medication.

Group 2 (128 cases).—Received 25 gms. of sulfadiazine orally in the first 72 hours after admission to the hospital.

Group 3 (75 cases).—Received 480,000 Oxford units of penicillin intramuscularly in the first 72 hours after admission.

These regimes represented the usual minimum dosages for prophylactic management. However, treatment was continued in many cases when indicated by high temperatures or by actual or impending complications. Table 1 gives the incidence of otitis media (and of mastoiditis) in the foregoing groups.

TABLE 1.—Incidence of acute suppurative media in 239 cases of scarlet fever

	Number of cases	Cases of otitis media	Percent	Cases of mastoiditis	Percent
Group 1 (no prophylaxis).....	36	9	25	0	0
Group 2 (sulfadiazine prophylaxis).....	128	20	15.6	2	1.5
Group 3 (penicillin prophylaxis).....	75	2	2.7	0	0
Totals	239	31	13	12	0.5

¹ One requiring operation. One responsive to penicillin therapy.

CASE REPORTS

The two cases of mastoiditis are of special interest.

Case 1.—A 23-year-old male was admitted to the hospital on 16 February, the first day of his scarlet fever rash. Despite a course of 25 grams of sulfadiazine, an acute otitis media with spontaneous drainage occurred on the fourth day. Aural drainage was profuse. Sulfadiazine therapy was stopped after 4 more days. From the fourth to the fourteenth day of the suppuration, 1,700,000 units of penicillin were given. Mastoid edema and tenderness were noted in the first week. On the fourteenth day a definite paralysis of the facial nerve was noted. There was also sagging of the posterior superior canal wall. The white blood count was 17,000. Roentgenograms of the mastoid revealed generalized cloudiness with thinning of the cellular walls. Simple mastoidectomy performed on the fifteenth day of the aural drainage revealed generalized necrosis. As no exposure of the facial nerve was noted, the paralysis was ascribed to inflammatory edema. Penicillin solution (1,500 units to the cubic centimeter) was instilled into the mastoid cavity at operation and twice daily thereafter via a small drainage tube left in situ. The postoperative course was uneventful. Seven hundred eighty thousand units of penicillin were given intramuscularly during the first 6 days after operation. Recovery of facial function began on the third postoperative day and was complete by the eighth day. The tympanic membrane closed after the subsidence of the drainage.

Case 2.—The patient, a 21-year-old male, had pneumonia on 12 December, followed by onset of scarlet fever on 26 December. From 12 to 22 December he received 60 grams of sulfadiazine and a subsequent course of 120 grams from 27 December to 26 January. Acute otitis media occurred on 5 January and persisted despite continued sulfadiazine therapy. Culture of the aural discharge revealed hemolytic streptococci. On 26 January moderate redness and tenderness were present over the mastoid process. There was no sagging of the superior canal wall. The white count was 28,050 and the temperature ranged up to 100.5° F. Roentgenograms showed moderate haziness of the cellular structure of the mastoid, but no definite necrosis. As the response to sulfonamide therapy was inadequate, penicillin was started on 26 January. Administration of 1,440,000 units in 7 days effected complete resolution of the mastoid inflammation with closure of the tympanic membrane. This illustrates a case of a sulfonamide-resistant organism which responded to penicillin.

Cases 3 and 4 are two instances of failure of penicillin prophylaxis to prevent otitis media.

Case 3.—The patient, 19 years of age, received no preliminary medication and developed an acute otitis media in the right ear 4 days after his rash. This sub-

sided after a course of 25 grams of sulfadiazine and 640,000 units of penicillin over a period of 6 days. Despite this therapy an acute otitis media subsequently occurred in the left ear, requiring an additional 640,000 units of penicillin to effect resolution of the infection.

Case 4.—The patient, age 24 years, developed an acute otitis media 6 days after completion of the initial course of 480,000 Oxford units of penicillin. The infection cleared after an additional course of 380,000 units.

Case 5.—The patient, age 29 years, received no prophylactic medication. On the seventh day after his scarlatinal rash the left ear began to ache. Examination revealed moderate redness of the drum and loss of landmarks. Despite bulging of the ear drum on the second day, complete subsidence resulted on the fifth day after administration of 740,000 units of penicillin.

Case 6.—The patient, age 25 years, developed a bilateral otitis media despite a prophylactic course of 36 grams of sulfadiazine. The left ear ceased draining after a total of 66 grams had been given. The right ear infection failed to respond to 90 grams. Administration of 640,000 units of penicillin in 4 days resulted in complete resolution of the suppuration in the right ear.

The following cases are complications other than otitis media and are not included in the tabulation.

Case 7.—The patient, age 24 years, developed a peritonsillar abscess despite a course of 37 grams of sulfadiazine given previously. Resolution without drainage followed administration of 720,000 units of penicillin.

Case 8.—A 30-year-old patient had received 360,000 units of penicillin in the first 2 days after admission. The throat culture on the third day became negative for hemolytic streptococci. On the tenth day following, the sore throat recurred and throat culture again became positive for hemolytic streptococci. An additional course of 240,000 units of penicillin resulted in a negative culture.

Case 8 illustrates the return of organisms after inadequate dosage of penicillin.

COMMENT

The occurrence of 31 instances (13 percent) of otitis media in 239 cases of scarlet fever may be compared with McMillan's statistics of 9 percent of scarlatinal otitis in a series of 1,700 cases (5).

In our series only one case required mastoidectomy (Case 1). This low percentage of surgical mastoiditis (3.2 percent of the group of otitic complications and 0.4 percent of the entire group of scarlet fever cases) may be attributed mainly to the efficacy of penicillin.

Of the remaining 30 cases, 12 subsided under sulfadiazine therapy alone in doses ranging from 30 to 97 grams.

Eighteen cases required penicillin. Six of these were treated solely with that drug in dosages varying from 720,000 units to 1,600,000 units.

The interesting group is that of the 12 cases in which penicillin was employed subsequent to the unsatisfactory therapeutic response to sulfadiazine in dosages as high as 96 grams. In these cases treatment with penicillin up to 1,440,000 units (averaging 937,000 units per case) was effective. While continued sulfadiazine therapy may have ulti-

mately controlled some of the otitic suppurations in this group, others must be classified as due to sulfonamide-resistant organisms.

The instances in which sulfadiazine failed to prevent otitis media may be divided into early and delayed onset of the complication. In 7 of the 20 cases (35 percent) otitis media occurred on or before the fourth day of the period beginning with the 3-day course of administration of sulfadiazine. In 13 cases (65 percent) the otitis media occurred from 6 to 13 days after the beginning of sulfadiazine administration. The average interval was 8 days. In these late cases it is presumable that the complication may be ascribed to the recrudescence of hemolytic streptococci in the bacterial flora of the pharynx after the initial control by the sulfonamide therapy. The studies of Meads (1) and his coworkers demonstrated that although hemolytic streptococci disappeared from the pharynx in cases of scarlet fever after oral sulfonamide administration, the departure was delayed and the organisms reappeared soon after cessation of treatment.

Plummer (2) et al., demonstrated the disappearance of hemolytic streptococci from the pharynx in severe acute inflammations after 48 hours of administration of 15,000 Oxford units of penicillin every 4 hours. However, they stated that the organisms returned if the course was less than 6 days.

We noted some alleviating effect of penicillin on the toxic or eruptive manifestations of scarlet fever after 48 hours of therapy. This does not entirely concur with the report of Meads et al., who observed little difference in the duration of fever, the rash, or the acute toxicity of treated and control cases in their series. In this connection the use of pooled convalescent serum should be emphasized. When available its use is highly advantageous. The comprehensive studies of Hoyne (6) and his associates demonstrated that convalescent serum produced prompt subsidence of the fever, toxemia, angina, and early fading of the rash.

Our results are in agreement with the conclusion of other observers that early systemic administration of penicillin prevents complications by the elimination of the hemolytic streptococci from the pharynx and nose.

SUMMARY

In 239 cases of scarlet fever, penicillin was found to be greatly superior to sulfadiazine in the prevention of acute otitis media as well as in the treatment of active otitic suppuration. Administration of 20,000 units every 3 hours for from 5 to 7 days is recommended.

REFERENCES

1. MEADS, M., FLIPSE, M. E., JR., BARNES, M. W., and FINLAND, M.: Penicillin treatment of scarlet fever; bacteriologic study of nose and throat of patients treated intramuscularly or by spray with penicillin and a comparison with sulfadiazine. J. A. M. A. 129: 785-789, November 17, 1945.

2. PLUMMER, N., DUERSCHNER, D. R., WARREN, H. D., ROGLIANO, F. T., and SLOAN, R. A.: Penicillin therapy in hemolytic streptococcal pharyngitis and tonsillitis. J. A. M. A. 127: 369-374, February 17, 1945.
3. LYONS, C.: Penicillin therapy of surgical infections in the U. S. Army; report. J. A. M. A. 123: 1007-1018, December 18, 1943.
4. WEINSTEIN, L. and ATHERTON, H. B.: Treatment of acute suppurative otitis media with penicillin. J. A. M. A. 129: 503-508, October 13, 1945.
5. McMILLAN, J. C., JR.: Seventy-eight hundred scarlet fever patients. U. S. Nav. M. Bull. 46: 89-91, January 1946.
6. HOYNE, A. L., LEVINSON, S. O., and THALHIMER, W.: Convalescent scarlet fever serum; its prophylactic and therapeutic value; review of 2,875 cases. J. A. M. A. 105: 783-789, September 7, 1935.

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EXPERIMENTAL STUDIES ON THE PHARMACOLOGY OF ACTIVATED CHARCOAL

It is evident that charcoal *in vitro* is a powerful adsorbent for nearly all the substances examined. Its adsorptive power is strongest for mercuric chloride, sulfanilamide, and the alkaloids; but it is considerable also for barbituric acid and its derivatives. As will be noticed, there is a great decrease in the adsorption when barbital is converted from acid to sodium salt; the cause of this difference will be dealt with in a subsequent paper.

It is further to be noticed that barbital sodium is adsorbed only half as strongly as the other sodium salts of barbituric acid derivatives. In this connection it is to be pointed out that barbital as a hypnotic is also considerably weaker than the other barbituric acid derivatives, suggesting the possibility of a certain relation between the adsorbability of the hypnotic and its hypnotic effect.

It is to be recommended, that only a recognized charcoal preparation be employed for the treatment of the acute intoxications. The best way of ensuring the physician's access to strongly and constantly active charcoal preparations is for the pharmacopoeias of the different countries to stipulate strict and suitable tests for the adsorptive capacity of active charcoal.

On the whole, however, it may be said that active charcoal in experiments *in vitro* has proved to be an effective adsorbent of the most common poisons.

The experiments here reported allow of no conclusion as to the effectivity of charcoal *in vivo*. This problem will be dealt with in a subsequent paper.—ANDERSON, A. H.: Experimental studies on pharmacology of activated charcoal. Acta Pharmacologica et Toxicologica. 2: 69-78, 1946.

THE INFLUENCE OF COMBAT ON THE INCIDENCE OF INTESTINAL PARASITES

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Troops returning from duty in the Tropics, and especially those subjected to combat conditions, will undoubtedly return to the United States with a high incidence of intestinal parasites. In order to determine the degree of this incidence, the following study was performed.

METHOD OF STUDY

The individuals studied were divided into three equal groups of one hundred. One group had been subjected to combat conditions. The second group had been stationed at an advanced base for eighteen months, but had no combat experience. The third group had arrived recently from the United States as replacements. The fecal specimens were examined grossly. A physiologic-saline direct smear and a direct smear stained with D'Antoni's iodine were examined. In addition zinc sulfate concentration and brine flotation concentration preparations were also made. All individuals who revealed pathogenic parasites received a complete blood count, hematocrit reading, and reticulocyte count. Only one fecal specimen was examined on each individual.

ANALYSIS OF RESULTS

A study of table 1 reveals a marked increase in pathogenic intestinal parasites in the group subjected to combat conditions. There appears to be no significant difference in the incidence of intestinal parasites among the recent replacements and the group stationed at an advanced base. Among the combat troops the increase in amebiasis and hookworm disease is particularly notable, while there is also a noticeable increase in incidence of *Strongyloides stercoralis* and *giardia lamblia*. Of the non-pathogenic parasites there is a noticeable increase in *Endolimax nana*, *Endamoeba coli* and *Trichuris trichiura* among combat troops.

TABLE 1.—Incidence of intestinal parasites in groups of 100

Parasite	Personnel type		
	Replacement	Advanced base	Combat
<i>Endamoeba histolytica</i>	3	6	23
<i>Endamoeba coli</i>	19	21	32
<i>Endolimax nana</i>	11	9	14
<i>Iodamoeba butschlii</i>	3	5	6
<i>Dientamoeba fragilis</i>	2	4	2
<i>Chilomastix mesnili</i>	1	2	0
<i>Trichomonas hominis</i>	2	1	0
<i>Giardia lamblia</i>	3	1	6
<i>Taenia</i>	1	1	0
<i>Dipylidium caninum</i>	1	2	1
<i>Hymenolepis nana</i>	1	0	1
<i>Heterodera radicularis</i>	1	0	1
Hookworm.....	6	4	25
<i>Strongyloides stercoralis</i>	1	0	7
<i>Ascaris lumbricoides</i>	4	3	6
<i>Trichuris trichiura</i>	2	3	8
<i>Balantidium coli</i>	0	0	1

In analyzing 57 cases admitted to the gastro-intestinal service during the period of this study, there is an incidence of intestinal parasites of 65 percent. Nine of these patients had multiple infections including nonpathogenic organisms. Table 2 reveals the incidence of intestinal parasites among 57 admissions to the gastro-intestinal service, regardless of combat experience.

TABLE 2.—Incidence of intestinal parasites among fifty-seven cases admitted to the gastro-intestinal service

Parasite	Cases	Percent	Parasite	Cases	Percent
<i>Endamoeba histolytica</i>	21	37	<i>Giardia lamblia</i>	3	5.26
<i>Endamoeba coli</i>	19	31	<i>Hookworm</i>	12	21
<i>Endolimax nana</i>	9	16	<i>Strongyloides stercoralis</i>	5	8.7
<i>Iodamoeba butschlii</i>	5	8.7	<i>Ascaris lumbricoides</i>	5	8.7
<i>Dientamoeba fragilis</i>	2	3.5	<i>Trichuris trichiura</i>	3	5.26
<i>Trichomonas hominis</i>	1	1.7			

Twelve cases of hookworm disease revealed an average blood count of 3.7 million erythrocytes and 10.4 grams of hemoglobin. The average hematocrit reading was 29 with an average mean corpuscular volume of 78. The eosinophile count varied between 6 and 82 percent with an average of 32.5 percent. In this connection one patient revealed 30 to 40 ova per low-power field and complained of marked prostration. On entry, his blood count revealed 2.2 million erythrocytes and 4.2 grams of hemoglobin. He required several courses of treatment and multiple transfusions before recovery. At one time he had an eosinophilia of 82 percent. Thirty-four individuals who harbored hookworm ova, but had a normal erythrocyte and hemoglobin level, revealed an eosinophilia varying between 7 and 20 percent, averaging 15.5 percent.

Sixty percent of the individuals harboring *E. histolytica* had an eosinophilia varying between 6 and 16 percent with an average of 8.4 percent. Other parasites which caused an inconstant eosinophilia were *G. lamblia* and *S. stercoralis*.

DISCUSSION

This study was made immediately following the invasion of the Palau Islands.

The sanitation on these Japanese-mandated islands was very inadequate and there was much dysentery and some deaths due to dysentery among Japanese prisoners. Japanese toilets were poorly constructed and were not flyproof. Many of these toilets were partially demolished by shell fire and some were overflowing due to heavy rains. Flies were large and numerous. Larvae could be seen in the open field type of toilet and in partially concealed Japanese bodies which had not been buried because of exposure to gunfire. It is not surprising that troops subjected to such conditions revealed a high incidence of intestinal disorders. Most of the cases of shigellosis were cured before return to this advanced-base fleet hospital, but the incidence of pathogenic intestinal parasites as revealed by this study was high.

CONCLUSIONS

1. Men returning from combat on islands in which the Japanese had been long established will reveal a high incidence of intestinal parasites.
2. Eosinophilia was constant in hookworm disease, present in 60 percent of individuals harboring *E. histolytica* and was inconstant in the presence of other intestinal parasites.

PENICILLIN IN THE TREATMENT OF LOUSE-BORNE RELAPSING FEVER

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Louse-borne relapsing fever appeared in Egypt in early 1945 after an apparent absence of over 20 years. During late summer and fall of this year penicillin was tried on a series of cases as a method of therapy, utilizing 52 treated patients and holding 53 as controls. These patients were inhabitants of Cairo or of nearby villages in Giza Province. All patients were hospitalized in the Imbaba Fever Hospital in Imbaba, Giza Province, or in the Abbassia Fever Hospital in Cairo.

CLINICAL CHARACTERISTICS OF DISEASE

Clinically the disease was relatively mild, with a fatality rate of 5 percent in the untreated cases. A typical case began suddenly with onset of severe headache, which was the constant symptom, accompanied in most instances by vomiting, chills, or both. Most patients developed generalized aches and pains, most marked in the back, knees and abdomen. The temperature mounted rapidly, reaching a maximum between 102° and 106° F., with a mean of 104° F. The initial bout of fever lasted 7 days on the average, with termination by crisis. The remission averaged 8 days in length, followed by an abrupt recurrence in which the mean duration of symptoms was 4 days. In the relapse, symptoms were very similar to the initial attack with fever reaching the same height, usually 104° F. The recurrence also ended abruptly. In this epidemic a second relapse was unusual.

FINDINGS ON PHYSICAL EXAMINATION

On physical examination the most constant findings were a tender enlargement of the liver and spleen. Lower abdominal tenderness was also common. Jaundice of varying degree, sufficient to tinge the sclerae, was observed in 33 percent of the patients. In several instances jaundice was of a marked intensity. Nuchal rigidity, some-

times very pronounced, was frequently encountered. Knee jerks tended to be hypoactive. Delirium was not more frequent than in other fevers of comparable elevation. In the chest, rhonchi were usually audible on auscultation, but dullness and changed breath sounds were infrequently encountered. A petechial or purpuric rash was noted in 6.5 percent of the patients.

During the relapse phase the signs tended to reduplicate those in the initial attack, except that jaundice and rash seemed to be associated only with the primary fever. The rapidity with which the liver and spleen could diminish in size during the remission and become enlarged again with the relapse was striking. The presence of *Spirochaeta recurrentis* in the blood smear was highly correlated with fever, both in the initial attack and in relapse. Positive smears were found only during fever or a few hours before the appearance of fever¹.

GENERAL PLAN OF STUDY

At Imbaba Fever Hospital both male and female patients were accepted. At Abbassia Fever Hospital only males were taken in the study group due to the availability of only one ward for this study in this institution. Ages of the 105 patients admitted and retained in this study varied from 5 to 60 years. Ninety patients were male, 15 female.

Patients were taken from the general hospital wards and admitted to our experimental wards on the following conditions: (1) Presence of fever; (2) A blood film positive for *S. recurrentis*; (3) A history of duration of symptoms of present illness of seven days or less; and (4) A history of no previous illness during the preceding month.

All patients found on the hospital wards who met these criteria were accepted in this study. Alternate cases in this series were treated with penicillin; the remainder served as controls, receiving only symptomatic care. In the event that several patients were discovered simultaneously in the hospital wards, selection was by hospital serial number. No deviation from such alternate selection was permitted.

All patients under treatment with penicillin were given the same dosage, 25,000 units intra-muscularly every three hours night and day until 1,000,000 units had been administered.

Control patients were given only symptomatic therapy except that in 3 instances it proved necessary to give specific therapy with neoarsphenamine to save life. These patients were excluded from the study.

All patients, both treated and control, were kept in the hospital under observation for 21 days after cessation of the initial fever.

¹ One blood smear in a control case was reported positive for *Spirochaeta recurrentis* on the seventh afebrile day following the first relapse.

During the entire period of observation blood films from each patient were examined twice daily. The Giemsa stain was employed. The oral temperature was recorded twice daily. All patients were seen daily.

EVALUATION OF TREATMENT

The effect of treatment was evaluated on the ability of penicillin to prevent relapse in the treated group. A patient was considered to have relapsed only if at some time subsequent to the initial bout of fever *S. recurrentis* were found in the blood smear. In one instance a positive blood smear occurred among the control group in the absence of fever. This was considered a relapse. In this series the effect of penicillin therapy was strikingly gratifying. With 2 exceptions, noted below, all treated persons were speedily restored to well being and remained free of fever. None of the treated patients relapsed.

Among the control patients the relapse rate was 87 percent. Thirteen percent of the control patients failed to relapse. In some cases this may possibly have been due to immunity established in the initial attack or due more probably to the patient's denial on admission of a previous attack which actually constituted the primary phase of the illness.

The comparative relapse rates of the two groups are shown in table 1.

TABLE 1.—*Relapse rate in penicillin and control patients, louse-borne relapsing fever, Cairo, 1945*

Type of patient	Number of patients observed	Number with relapse	Percent relapsing
Penicillin treated.....	52	0	0.0
Control.....	53	46	87.0

COMMENTS

In an attempt to save life it became necessary to treat 3 of the control patients.

The first control patient treated specifically was a young woman who had aborted 3 days prior to her entry to the hospital. She was given neoarsphenamine and penicillin the day following admission to the hospital. At necropsy the fact was established that she was suffering from puerperal sepsis as well as relapsing fever. This patient was not included in the study.

The second control patient was treated because of intense jaundice and evidence of grave liver damage. He recovered promptly after receiving a course of neoarsphenamine. This patient was not included in the study.

The third control patient was treated in relapse, his illness having been complicated by an extensive bilateral bronchopneumonia and markedly severe parotitis. He was included in the control group by

reason of recurrence of blood smears positive for *S. recurrentis* on the ninth and tenth days following the termination of the primary episode of his relapsing fever. This patient experienced an increased elevation of fever with return of positive blood smear and became critically ill. He was given neoarsphenamine, 0.6 gram, and his condition improved greatly during the following 24 hours. He was later treated with penicillin because of complicating pneumonia and parotitis. It was felt that since this patient had gone into relapse, he had served his purpose as a control and the administration of penicillin at that point should not preclude his being used as a control. This patient also recovered.

Two penicillin-treated patients developed concurrent typhoid fever. One of these remained free of fever for several days following treatment of his relapsing fever. Thereafter he followed a course typical of typhoid fever, developed a positive Widal reaction, and eventually recovered. No *S. recurrentis* were found in his smear subsequent to treatment.

The other patient entered with both typhoid and relapsing fever apparent. Penicillin treatment freed his blood of *S. recurrentis*, but he remained febrile, developed a positive Widal reaction, and died of typhoid fever.

One patient in the penicillin series at Imbaba Fever Hospital was admitted to the ward in labor and was delivered of a 7½-month premature infant. The mother made an uneventful recovery.

It is of course possible, that had we been able to observe our patients longer, that some of the penicillin-treated cases would have relapsed. The 21-day period subsequent to cessation of initial fever was the longest practical length of observation. Inasmuch as the length of remission in the controls was 7.7 days with a standard deviation of 2.3 days, the 21-day period is statistically and clinically sound.

Subsequent to the termination of the study one of our penicillin group patients reappeared in the hospital with relapsing fever. He was not treated with penicillin. During this second hospital stay he had a remission followed by a relapse. The interval between his discharge from the experimental ward and his reentry to the hospital was 42 days. This is considered to represent a reinfection rather than a therapeutic failure since the patient had remained afebrile and asymptomatic for 63 days. It can not be stated with certainty that he does not represent a treatment failure.

CONCLUSIONS

1. Fifty-two patients with Egyptian louse-born relapsing fever received 1,000,000 units of penicillin each in 25,000 unit doses intra-

muscularly every 3 hours. A cure of the relapsing fever was obtained in all 52 cases.

2. No relapses occurred in the treated group.
3. Relapse occurred in 87 percent of the 53 cases used as controls.

ACKNOWLEDGMENT.—Grateful acknowledgment is made to the Directors of the Abbassia and the Imbaba Fever Hospitals, Dr. Mahmoud Abo Bakr El-Demerdash Bey and Dr. Aly Hassan El-Ramly Bey for supplying clinical facilities as well as valuable guidance and advice.



A COMBINATION TREATMENT FOR LICE AND SCABIES

Authors' discussion.—In general an aqueous emulsion would prove less desirable against head lice than an alcoholic solution. The solution usually evaporates much quicker and is more pleasant to use than the emulsion. Rapid evaporation or drying appears to be about the only advantage the alcoholic formula has over the emulsion. However, of the several hundred cases of head lice treated with NBIN, few patients considered the treatment objectionable, and most of them found it pleasant. The presence of the treatment agent is not detectable within a few hours after application.

Treatments for crab lice or scabies should cause as little irritation as possible, since they must be applied to the more tender areas, such as the genital region. Most of the treatments now in wide use against crab lice or scabies are either ointments or emulsions. No doubt this is due mostly to the fact that there are no pleasant, non-irritating effective compounds available for other types of preparations. Vehicles that are nontoxic and nonirritating when applied in undiluted form to the more tender areas of the body are urgently needed for various formulations.

No cases of dermatitis have resulted from treatments made with the formulas discussed in this report. The emulsions have a slight smarting effect on open lesions and on the genitals, but this is of short duration. The formula is *considered much less irritating than the benzyl benzoate emulsions now used for scabies, since it contains only about half as much benzyl benzoate*. Alcoholic solutions are objectionable because of their rather intense, although temporary, burning of the genitals.

The foregoing discussion is based mostly on laboratory and carefully controlled clinical tests. However, extensive field tests against lice and scabies have been made with the NBIN formula. The results of these tests will be reported later.—EDDY, G. W.: Combination treatment for lice and scabies. *J. Invest. Dermat.* 7: 85-91, April 1946.

DIAGNOSIS AND SURGICAL MANAGEMENT OF THORACOABDOMINAL WOUNDS ABOARD AN ASSAULT TRANSPORT

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Fortunately patients with thoracoabdominal injuries coming aboard an assault transport are not common, but successful evacuation and care of them may present a major surgical problem in amphibious warfare.

Any large amphibious operation resulting in the admission of one hundred or more casualties to an assault transport will likely present a patient with a thoracoabdominal injury.

Due to lack of nursing facilities and the pressing need of other problems it is advisable when possible to transfer these patients to a hospital ship after the abdominal condition has been taken care of. However, this is not always possible and it may be necessary to administer the postoperative care for several days while the transport is en route to a base hospital. If these cases are not complicated by a persistent hemothorax their postoperative care will present no greater problem than any other intra-abdominal injury. However, a patient hemorrhaging above and below a perforated diaphragm, with a respiratory rate between 60 to 70 and presenting the classical signs of a perforated abdominal viscus is a trial for any surgeon.

Having been confronted with this problem, which was successfully handled aboard ship, and having had the opportunity of observing other such patients in an Army general hospital, following an amphibious operation, the author has been prompted to record a few simple rules concerning the management of these desperate cases. To discuss the diagnosis and to advocate conservatism in the care of the chest injury in thoracoabdominal wounds whenever possible, and to suggest how this can be carried out is the purpose of this article.

It was observed that after exploratory laparotomy, which included taking care of the injury to the abdominal viscus and closing the perforation in the diaphragm, that a policy of absolute conservatism insofar as the chest wound is concerned will usually produce the best results.

Absolute conservatism must not be construed to mean that these patients do not need any care after the abdominal viscera have been re-

paired, intra-abdominal hemorrhage checked, and the damage to the diaphragm repaired. Absolute conservatism means that after the afore-mentioned major surgical procedure has been completed one is almost never justified in opening up the chest aboard an assault transport for the purpose of controlling hemorrhage.

To advocate allowing an intrathoracic hemorrhage to go on unabated seems contrary to all surgical principles, but it is not as bad as it seems if proper supportive measures are instituted.

McMahon and Huston (1) report a series of 81 perforating wounds of the chest with hemothorax occurring in 18 cases. There was not a single case of fatal hemorrhage and in no instance was it necessary to open the chest to control the hemorrhage. Here is an excellent example of a large group of cases successfully treated conservatively. There were 6 deaths in their series of 81 cases but in no instance could death be attributed to hemorrhage or hemothorax alone.

Certainly conservatism is even more imperative where the patient has just been subjected to an exploratory laparotomy and its attendant hazards, such as one encounters in thoracoabdominal wounds.

Of course, it must be borne in mind that McMahon's and Huston's 18 cases were all treated in a base hospital where the time elapsed between injury and admission was from 9 to 42 hours, so it is just conceivable that a very occasional case with a severed intercostal artery might have terminated fatally en route. By the same token, however, it might be well to mention their splendid results were obtained in a base hospital where positive pressure anesthesia, a large staff of nurses and all other facilities were at their command, and notwithstanding this fact, they adhered to a policy of strict conservatism. It behooves surgeons on attack transports to consider well the indications for opening chests of critically ill patients who have just been subjected to an abdominal operation and repair of an abdominal viscus and closure of a perforated diaphragm.

The only place where the author cannot agree with McMahon and Huston in their policy of strict conservatism is in thoracentesis for hemothorax. It is my belief the presence of blood in the pleural cavity, if not removed, will produce very definite ill effects. Blood, by its pressure on the outside of the lung, will produce a massive atelectasis. The blood will then clot forming an organized layer of fibrin about 1 cm. in thickness covering the entire compressed lung. And even if the remaining blood or fluid is aspirated the lung remains collapsed and nothing will expand it until after the chest is opened surgically and that thick layer of almost leathery material manually removed from the surface of the lung. X-ray examinations 2 or 3 hours after operation will find the previously collapsed lung expanded 75 to 90 percent of normal. Of course this is not an emer-

gency procedure but it is surgery that can be avoided if repeated thoracentesis is performed.

The chest cavity when well filled with blood becomes more or less immobilized and if not aspirated the blood will clot a great deal more rapidly than will a smaller amount of blood in a chest where active respiratory motion is taking place.

On the chest service in a large Army General Hospital where a number of chest cases were operated on because of inadequate aspiration, the consensus of opinion was that all blood should be removed and kept removed from the chest in every case of hemothorax. This could be safely done after 48 hours had elapsed following the injury, even though some active hemorrhage might still be present.

As high as 3,000 cc. of blood have been removed at this hospital at one time and without any untoward results. After having opened a number of chests and seeing the effect of unaspirated blood attached to the surface of the collapsed lung this particular hospital staff insisted on repeated and complete aspirations in every hemothorax even in the face of active hemorrhage. They demonstrated to the author the importance of keeping a chest "dry", as they called it, even if it were necessary to attach a suction apparatus to a catheter in the pleural cavity.

This heroic measure may never need be resorted to, however, as complete aspiration of the chest twice a day will suffice.

The author was able to handle a particularly desperate thoraco-abdominal case aboard an attack transport by aspirating the chest as dry as possible twice per day for 5 days. The amount that could be aspirated each time was usually just about a pint. A pint of whole blood was given intravenously twice a day to replace the blood loss. At the end of 5 days, after 10 pints of blood had been aspirated from the chest and 10 transfusions of a like amount had been given, the hemorrhage ceased.

This was a thoracoabdominal shrapnel wound with a 1½-inch ragged rent in the dome of the right diaphragm and a deep lesion of similar design in the dome of the right lobe of the liver accompanied by profuse liver hemorrhage.

The respiratory rate was 70 during and after the laparotomy which was done through a Kocher right subcostal incision in order to close the rent in the diaphragm and pack the liver wound to control the hemorrhage. The abdomen contained a large amount of free blood which was removed.

It was gratifying to see the improvement in the patient's postoperative condition following each aspiration.

There is an additional reason why repeated and thorough aspirations of the chest are needed in patients with thoracoabdominal injuries as compared to those uncomplicated chest wounds with an

ordinary hemothorax. That is the likelihood of the repair in the diaphragm disrupting due to the blood in the pleural cavity causing the sutures to absorb sooner than they ordinarily would. It is better to use heavy silk, in the repair of the diaphragm in order to obviate this difficulty.

What has been said here in favor of conservatism in the handling of hemothorax associated with thoracoabdominal wounds can be applied to any case of hemothorax as so admirably pointed out by McMahon and Huston. Oxygen and the general supportive measures used in the treatment of shock and hemorrhage from any cause are also indicated.

The diagnosis of thoracoabdominal wounds is not always easy to make and even when there is a wound of exit there may still be considerable doubt as to whether or not the peritoneal cavity has been penetrated. Whenever a simple chest wound does not seem to adequately explain the serious symptoms accompanying it, one should look for other wounds in unusual locations such as the perineum, natal cleft, axilla, etc. which may help to establish immediately the diagnosis of a thoracoabdominal wound.

Palpation of the abdomen may be misleading in the presence of a chest wound. Generalized abdominal rigidity indicates the missile has probably entered the peritoneal cavity. A simple chest injury may be accompanied only by rectus muscle rigidity on the corresponding side.

Vomiting is more likely to occur if the abdomen is involved than in the presence of a simple chest wound.

X-ray examination in different planes may confirm the diagnosis but should never be considered a substitute for clinical judgment. The air so often seen under the diaphragm following a ruptured peptic ulcer is not seen now, even though the stomach or small bowel may have been penetrated, because the diaphragm itself has been perforated and is no longer air tight.

The presence or absence of liver dullness is not to be relied on and one should remember that a perforated diaphragm will probably allow air underneath it to escape into the chest.

Of course the desperate cases with feces extruding through a wound in the chest wall present no diagnostic problems.

When the dyspnoea and anemia appear to be out of all proportion to the severity of the chest wound hemothorax due to a severed intercostal vessel must be suspected. An x-ray examination will help to establish the presence of fluid blood in the chest and if accompanied by pneumothorax the characteristic splashing wound may be elicited. Dullness on percussion, absence of breath sounds, and thoracentesis are also valuable aids in diagnosis.

The characteristic swishing sound of an open pneumothorax is of course diagnostic and the simple procedure necessary to close this wound and stop the ingress of air is imperative and also comes under the list of conservative procedures.

The characteristic picture of traumatic pneumothorax with its extreme restlessness, cyanosis, shortness of breath, distended jugular veins, and anxious facies is not easy to forget.

The abdominal organs most likely to be involved in thoraco-abdominal wounds, according to Jolly (2) are in descending order of frequency: The liver, stomach, spleen, transverse colon (or the colonic flexures), the jejunum, and the kidney.

If the missile entered the right side of the thorax the possibilities are good that it may have only perforated the diaphragm and lodged in the liver, thereby sparing the hollow abdominal viscera. While x-ray may help to confirm this suspicion, exploratory laparotomy through a Kocher right subcostal incision is indicated in order to control the liver hemorrhage if present and to close the perforation in the diaphragm.

The author has favored the Kocher (3) incision for many years when dealing with liver injuries because it facilitates exposure to the right lobe of the liver and right diaphragm, is less likely to produce postoperative hernia and enables the bringing out of liver packs or abdominal drains far laterally thereby diminishing the likelihood of symptoms producing adhesions around the duodenum.

SUMMARY

Conservative handling of chest wounds complicating intra-abdominal injuries is stressed—especially aboard an assault transport.

Repeated thoracentesis and blood transfusions in the presence of continued hemorrhage is discussed.

Where thoracentesis has not been adequate, open operation often-times has to be performed to peel off the fibrinous deposit from the surface of the collapsed lung before expansion of the lung is possible.

The Kocher subcostal incision has distinct advantages in dealing with a lesion of the upper abdomen or in the diaphragm.

REFERENCES

1. McMAHON, A. and HUSTON, H. R.: Symposium on first year of activities at U. S. Naval Base Hospital ———; war wounds of chest; report of 278 cases encountered at U. S. Naval Base Hospital ———. U. S. Nav. M. Bull, 41: 1579–1587, Nov. 1943.
2. JOLLY, D. W.: Field Surgery in Total War. Hamish Hamilton, Ltd., London. 1940. pp. 211–214.
3. O'NEILL, J. N.: Traumatic rupture of liver. California & West. Med. 54: 68–70, Feb. 1941.

THE RECOVERY OF THE PATIENT
IS THE FIRST CONSIDERATION
OF THE PHYSICIAN—Hippocrates

EDITORIALS



HIPPOCRATES AND MODERN MEDICINE

The Recovery of the Patient Is the First Consideration of the Physician. This a free translation of one of the many simple truths set forth in the Hippocratic writings. Many of them seem almost too obvious to require a statement, yet they are like the axioms of mathematics, obvious, though fundamental. Also, like many other things of importance, they are so frequently forgotten that they need repetition. This one aphorism of Hippocrates is often forgotten or disregarded but should be written in letters of gold on the wall of every physician's examining room, so that he is constantly reminded of it.

In this day of laboratories, and technical aids, medicine as a science has tended to displace medicine as an art. The importance of mastery of the clinical art is not fully appreciated, yet without it the patient, who may be old, or very young, feeble, or neuropsychiatrically inadequate, is often exhausted and terrorized by routine examinations. A full knowledge of the patient as an individual, of his social surroundings, of the effects of illness on his work, ambitions, family, and finances, all this is necessary to properly treat him. In a recent article by Doctor Egon E. Kattwinkel, published by the National Board of Medical Examiners, there appears this significant statement:

I have been impressed in observing the students under my care, with a real deficiency in their knowledge of what constitutes the art of medicine. They are imbued with a hot devotion to the science of their profession, showing keen interest in the technique of diagnosis, with special emphasis on laboratory and other technical aids, but when questioned about the social history of the patient or the minute details of treatment on which the practice of the care of the patient so often depends, they answer in generalities that indicate a lack of an appreciation of the importance of such knowledge.

It was one of the greatest clinicians of all time, Thomas Sydenham, who said that the best book for a doctor to read was *Don Quixote*. In other words, he was emphasizing the importance of a knowledge of humanity on the part of the physician. Another master clinician,

Dr. Will Mayo, said, "Before you do anything to a patient, ask yourself if it is what you would want done to you if you were the patient."

The art of medicine is not easily learned. It takes natural inclination and it takes experience. Some are peculiarly fitted to be physicians and have tact, courtesy, and a kindly and sympathetic interest in people. Example and training, however, are needed, and much of this was obtained in the old preceptor method of teaching, which the impersonalized science of our present medical schools does not replace.

This aphorism of Hippocrates, *The Recovery of the Patient is the First Consideration of the Physician*, has been selected to be placed at the head of the editorial section as a motto and will continue to appear as a permanent part of the page head of the section.



THE DECLINE IN MORTALITY FROM APPENDICITIS

The business of life insurance companies is based on exact statistics of morbidity and mortality, and their reports contain information of great value to students of public health.

Among recent information of great interest is the distinct decline in deaths from appendicitis during the years from 1940 to 1943 in which there have been about 40 percent less deaths from this disease. A more dramatic drop is shown if the number of deaths in 1930 is compared with 1943. The number of deaths from appendicitis in the latter year was less than one half the former. In the Navy the deaths per 100,000 from appendicitis was 5.35 in 1939 and only 0.5 in 1944. This is really an astonishing decrease as the 1944 rate is approximately one-tenth the 1939 rate. In 1939, with 149,618 as the Navy and Marine Corps strength, the actual number of deaths was 8. In 1944, with a strength of 3,349,798, the total number of deaths was only 18.

The causes of this lessening of the mortality from appendicitis are not known with certainty. However, it would appear that there are several factors which have contributed to it. One is the extensive campaign against the indiscriminate use of laxatives in abdominal pain and the education of the public in seeking early treatment in cases of pain and tenderness of the lower right abdomen. During the war period the large numbers of young men in the Army and Navy must have had a profound influence on the decline in deaths from appendicitis. Appendicitis is a disease of their age group and at the time of highest susceptibility these men were in the military service and under constant medical observation. Diagnosis was early and treatment prompt. These facts must have had much to do with the remarkable lowering of the appendicitis figure in the population as a whole and in the Navy and Marine Corps particularly.

The effects of the newer chemotherapy, by the use of the sulfonamides and penicillin, is the leading factor in the opinion of many. Possibly this is true, but it is certain that all the factors mentioned were concerned. The 1944 rate in the Navy and Marine Corps represents a low in appendicitis deaths probably never before attained in so large a group in the age period of greatest incidence of the disease.



EARLIEST RECORDED INSTANCE OF THE USE OF BIOLOGICAL WARFARE

What is probably the first mention of biological warfare, or at least the recommendation to employ it, is contained in a book published by Allen E. and Esther W. Stearn on "The Effect of Smallpox on the Destiny of the AmerIndian." This shows that during the French and Indian War the idea of using smallpox in this manner occurred to some of the military commanders and indeed there is evidence that it was used. The following is a quotation from the afore-mentioned work:

"During an Indian uprising when attempts were being made to destroy the British garrison and the posts west of the Allegheny Mountains, Sir Jeffrey Amherst, commander-in-chief of the British forces, harassed by the knowledge of his limited resources and by the extent and seriousness of the revolt, wrote in the postscript of a letter to Bouquet the suggestion that smallpox be sent among the disaffected tribes. Bouquet replied, also in a postscript, 'I will try to inoculate the * * * with some blankets that may fall into their hands, and take care not to get the disease myself.' This could easily have been done since smallpox had broken out in Fort Pitt, where Bouquet was stationed. To Bouquet's postscript Amherst replied, 'You will do well to try to inoculate the Indians by means of blankets as well as to try every other method that can serve to extirpate this exorable race.' On June 24, Captain Ecuyer, of the Royal Americans, noted in his journal: 'Out of our regard for them (i. e., two Indian Chiefs) we gave them two blankets and a handkerchief out of the smallpox hospital. I hope it will have the desired effect.' A few months later the smallpox raged among the tribes of the Ohio, and even the following spring nearly a hundred Mingoes and Delawares and some Shawanoes died of it."

This is probably the first recorded instance of the actual use of biological warfare by organized military forces. The exact date of the correspondence is not given, but it was probably in 1761 or 1762 when Amherst was faced with the difficulties of the Pontiac uprising.



CLINICAL NOTES



PROSTHETIC RESTORATION FOLLOWING SHRAPNEL INJURY OF MANDIBLE

HARRY E. DENEN

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The amount of destruction of bone occurring after an injury, either to the maxilla or mandible, presents, many times, a prosthetic problem that challenges the ingenuity of the prosthodontist. What may appear to be a rather simple appliance to construct sometimes presents a few unseen difficulties that must be ironed out before the desired end result may be obtained.

In most of these cases, there is always evidence of fracture of either the maxilla or mandible or both. Reduction and subsequent splinting of the parts always creates a muscular trismus after the wires or splints have been removed. Although this situation is temporary, neverthe-

less when there is need for construction of prosthetic appliances, the constriction of the intermaxillary space due to this temporary deformity makes the taking of successful impressions, sometimes, quite difficult.

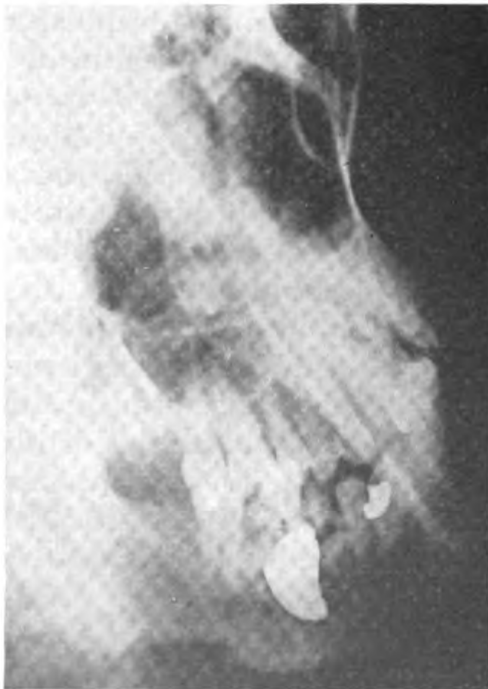


FIGURE 1.—Pieces of shrapnel embedded in body of mandible.

Case report.—A Navy lieutenant received a shrapnel wound of the mandible, among other injuries, while on duty aboard the U. S. S. *Surannee*. During a kamikaze attack he was struck by a bomb fragment, a part of which shattered the dorsal surface of the mandible, with some of the fragments lodging underneath the tongue. He was transferred to a hospital ship where fracture of the mandible was reduced and penicillin and sulfa therapy instituted. Upon transfer to this activity, shrapnel fragments and shattered teeth were removed and fracture was rewired.



FIGURE 2.—Shrapnel removed and fractured jaw wired.

Except for the appearance of occasional small sequestra, the healing of the fracture was uneventful. Because of the extensive loss of bone in this area it was deemed best to retain the third molar (number 32) although the mesiolingual root was partially exposed where some of the periosteum had been destroyed. At the present writing this tooth is vital and very firmly embedded in bone, and it is felt that with a certain amount of patient care it will be retained in good health indefinitely. At some later date if this tooth should have to be removed, it could be done without fear for the security of the fracture heal and callus.

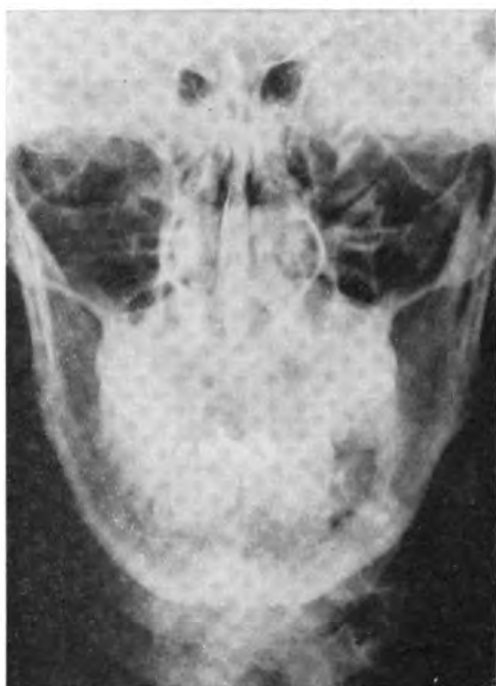


FIGURE 3.—Antero-posterior view showing fracture healed with parts in alinement and teeth in good occlusion.



FIGURE 4.—Lateral view showing great amount of bone destruction.



FIGURE 5.—Intra-oral appearance of bone loss.

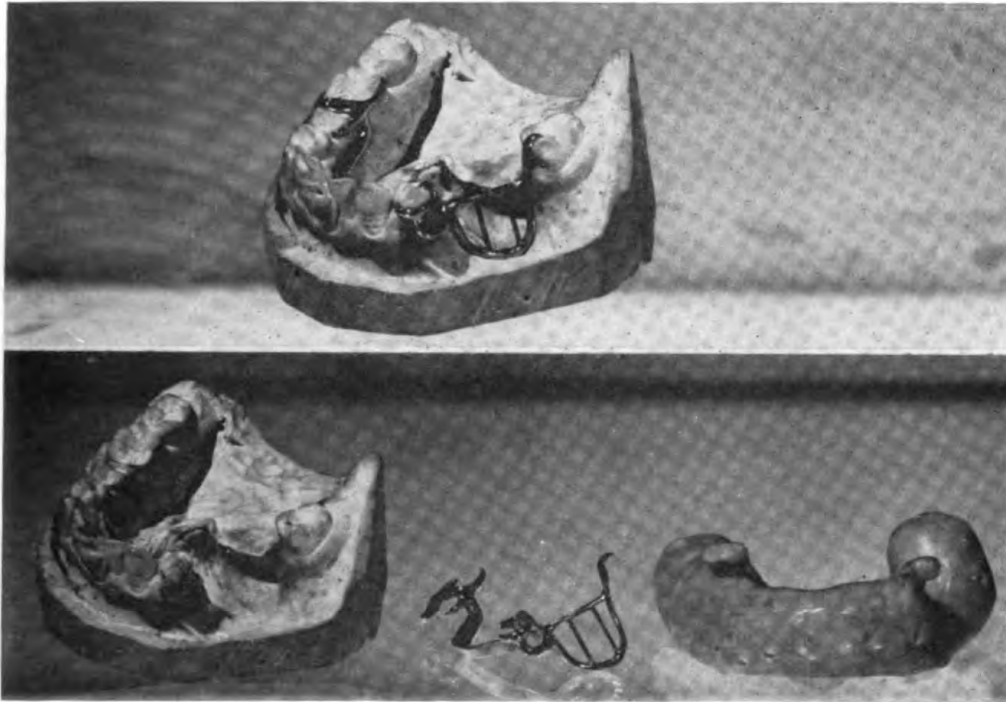


FIGURE 6.—Gold skeleton appliance and model of lower jaw with special acrylic tray which was necessary to obtain an accurate impression.

When the prosthetic work was eventually started, we were confronted with the problem of getting a good impression of the lower jaw. The existing trismus made it impossible to use an ordinary impression tray because there was not sufficient intermaxillary room to remove the impression intact. The great concavity formed by the loss of bone necessitated raising the impression twice its height so that it could be removed. A special tray was constructed of acrylic resin (fig. 6). This was fitted and trimmed so that a minimum amount of interference would be encountered by the upper jaw when the impression was ready to be removed.

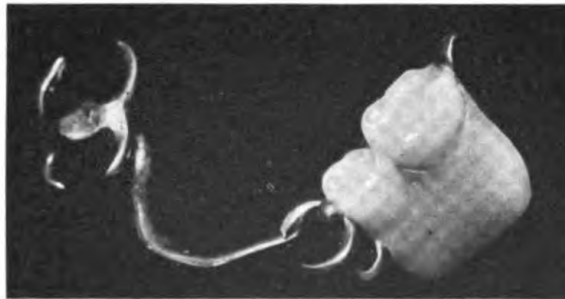


FIGURE 7.—Completed partial denture.



FIGURE 8.—Completed prosthesis in place showing restoration of lost parts and reestablishment of occlusion.

The gold skeleton (fig. 6) was designed so that strength could be embodied into the appliance without increasing its bulk. As there was no saddle area for the denture to rest upon, every precaution had to be taken for the protection of the teeth which were necessary to help support the denture. We have been checking the patient since the appliance has been inserted and to date, 3 months later, all tissues around the denture are normal and healthy and the patient reports that the prosthesis is functioning comfortably and efficiently.



HEALING OF A FRACTURE AFTER DELAYED TREATMENT

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and

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This presentation is to demonstrate the speed and accuracy with which realignment and healing of bone will take place when proper measures are instituted even after long delay and with concomitant severe intrathoracic damage.

CASE REPORT

The patient, a 30-year-old Marine private, was promptly brought to the field hospital after being hit by enemy rifle fire and thrown against his machine gun, resulting in the injuries enumerated.

The bullet entered the right anterior chest wall at the level of the first rib. It coursed downward through the lung, leaving the chest through the right scapula at the level of the seventh rib producing a pneumohemothorax and two sucking chest wounds. Comminuted fractures of the first and seventh ribs and of the right scapula occurred. The additional damage, simple comminuted fracture of the mid-portion of the right humerus, occurred on falling against his weapon.

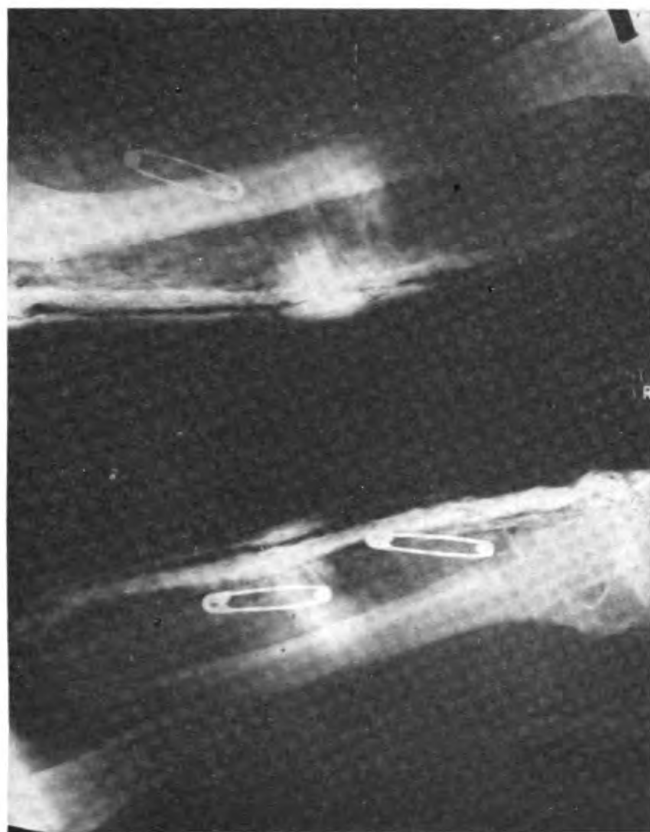


FIGURE 1.

Prompt treatment was instituted. The sucking wounds of the chest were closed and dressed. Five hundred cubic centimeters of whole blood were given, and penicillin, 25,000 units every 3 hours, sulfadiazine, 1 gram every 4 hours, and morphine $\frac{1}{4}$ grain every 4 hours as needed, were started. A posterior plaster splint was applied to the arm with no attempt at reduction.

During the next 4 days 290 cc. of blood were removed from the chest and an additional unit of plasma was administered. On the fifth day he was received aboard ship for evacuation. His temperature was 99° F. He was very pale and coughing small amounts of bloody sputum. Red cell count was 3,000,000 and the white count was normal. The only complaint other than weakness was pain in the region of the right elbow.

The patient was placed on a soft diet and high fluid intake by mouth. Sulfadiazine then was omitted and penicillin changed to 20,000 units every 3 hours and continued for 10 days.

Chest symptoms cleared rapidly and the only unusual occurrence was an attack of severe abdominal cramps which were relieved by atropine and an enema.

Because of the damage to the chest wall and hemothorax the fracture of the right humerus was left undisturbed in the original posterior splint without reduction for 18 days. Its appearance at this time is shown in figure 1. The splint was removed and several pressure sores cleaned and dressed. The fracture site was not tender to pressure and was fairly stable, indicating beginning union. A heavy hanging cast weighted with a lead plate was applied. Following this the patient was allowed to be up about the ward. His strength and endurance increased rapidly on becoming ambulatory.

COMMENT AND SUMMARY

This method is suitable for fractures below the insertion of the pectoralis major and in patients who are ambulatory. Some difficulty



FIGURE 2A.



FIGURE 2B.

may be experienced in obtaining cooperation from younger children since resting the weight of the cast nullifies its purpose.

Its advantages are simplicity of application, minimal interference with patient's activity, and the fact that exercises may be carried out which prevent muscular atrophy and possibly speed healing.

Antero-posterior angulation can be corrected by adjustment in length of the sling. Medial or lateral angulation can be corrected by the application of a fulcrum in the form of a roll of felt or cotton at the medial side of the arm.¹

Care must be taken to have sufficient x-ray re-examinations to insure that the fragments are not pulled completely apart by the heavy cast. This, of course, will result in nonunion because of the interposition of soft parts between the fragments.

¹ Compere, E. L., and Banks, S. W. : Pictorial Handbook of Fracture Treatment. (General practice manuals.) Year Book Publishers, Inc., Chicago, 1943.

The speed in correction of the deformity is shown in figures 2 and 3. Figures 2A and B shows the position after 8 days. Realignment has begun although not yet complete. Recovery was uneventful. There was never any complaint of pain or discomfort in the arm after



FIGURE 3A.

the weighted cast was applied. Figures 3A and B show position and degree of healing 14 days after application of the cast. Accurate realignment has occurred and there is only very slight shortening. Union is well on its way toward completion.

This case is cited as an example of the speed of realignment and healing which occurs in bone in the young adult even after a necessary delay in beginning treatment of 18 days while the fragments remained in malposition.



FIGURE 3B.



LEUKEMIA ABOARD A DESTROYER

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and

JAMES H. WEAVER

Pharmacist's Mate, first class, U. S. N. R.

There are many vexing problems which continually confront the medical profession and this report poses some which are indigenous to a destroyer medical officer.

CASE REPORT

The patient, age 28, reported to sick bay on 2 May 1945. He complained of malaise and night sweats for past 3 days which were interfering with his

work. History revealed that he had been feeling sub par since December 1944 when he was hospitalized for a week with bronchopneumonia. Since then he lacked his usual drive, and his fondness for wrestling was rapidly waning. A systematic review revealed a gradual loss of appetite, irregular bowel movements, persistent, dull, parietal headache and a sore throat along with his original complaints of malaise and night sweats. Within the last day or so he noted, too, that he became dyspneic on moderate exertion. The patient had had the usual childhood diseases and a long history of acute catarrhal fever attacks culminating in a bout of rheumatic fever at the age of 14. This necessitated bed rest for 2 months and a gradual return to the less exhausting exercises as some of his joints, ankle and knee, were swollen for quite some time. There was a history of tuberculosis in a sister, but contacts were very rare.

Physical examination revealed a taut, underweight individual with a light bronze pallor. But for a slightly injected oropharynx and a temperature of 99.8° F., there were no other positive findings. Laboratory tests revealed a normal urine analysis and a WBC of 26,000, lymphocytes 90 percent, and 10 percent undetermined cells, RBC of 4,860,000, Hb. 90 percent, sedimentation rate 15 min/45 min-6mm/19mm., blood pressure 118/60-56. Complete bed rest, high caloric, high vitamin diet with complementary feedings of egg-nogs and fruit juices were prescribed.

The following day, 26 May 1945, the patient complained of pain in the left apex on deep inspiration. An examination revealed a generalized lymphadenopathy of all the glands of the body with the right inguinal gland swelling to 3 cm. by 3 cm. The oropharynx was studded with sanguineous blebs, and the left hypochondriac was tense with a possible palpable spleen. Laboratory findings were WBC of 39,140, lymphocytes 98 percent, undetermined cells 2 percent, RBC of 4,400,000, sedimentation rate of 15 min/45 min-7 mm/21 mm., blood pressure of 120/60-54. Scrapings from the pharynx were negative for fusiform and spirochete bodies. A mouth wash was prescribed. At 0200, 27 May 1945, patient was awakened with a severe lancinating pain in his left hypochondriac and was in mild shock when seen. The spleen was now definitely palpable and the liver was one finger breadth below costal margin of rib. The pain rapidly subsided and for the next 4 days the patient felt comfortable except for the persistence of the slight diurnal temperature. There were no significant laboratory changes during this period. However on 31 May 1945, the WBC was 92,240, lymphocytes 100 percent, RBC of 3,560,000, sedimentation rate of 15 min/45 min-15 mm/28 mm. Examination revealed a spleen enlarged two times, liver palpable two fingers below costal margin, and an area of ecchymosis 4 by 1 cm. on right lateral thigh. Patient stated that he bruised his thigh when the ship rolled. With this drastic change in the blood picture any of our prayerful hopes that it might not be a leukemia were dissipated and active measures were secured for immediate transfer.

COMMENT

It was difficult to determine the differential count; a view which has been expressed by others in similar cases (1) (2). The Wright stain aboard destroyers is made by dissolving a tablet in methyl alcohol. Numerous smears were taken in which the time, pH, buffers, etc. were changed. However, the cytological features of the predominant cell fitted no textbook illustration. The cell resembled a large lymphocyte more than any other type and the 10 and 2 percent undetermined cells appeared to be degenerated polys. This opinion was shared by a

consulting medical officer. The white count was made by listing only those cells which appeared to be most stationary; an expedient necessitated by high speeds and frequent rolls of the ship. This method is fairly reliable.

The clinical findings were very similar to those of the anginose insidious type of infectious mononucleosis. In this condition a WBC of 30,000 or above with 90 percent lymphocytes is not unusual (3) (4). It was not until the sudden sharp increase of WBC to 92,000 and RBC decrease to 3,500,000 that we abandoned this thought. Heterophile antigen was not obtainable.

A color plate of a stained smear of the blood of this patient appears opposite page 10 in the January 1946 issue of the U. S. NAVAL MEDICAL BULLETIN.

It is felt that a copy of the medical history sheets should be kept in officers' Health Records for possible diagnostic aid.

SUMMARY

A case of leukemia was presented with some problems indigenous to a destroyer doctor.

This case terminated fatally 18 June 1945. The hematologist's report of the cells in question after an oxidase stain was "cells of the myeloid series."

REFERENCES

1. STURGES, C. C.: Leukemias, in CECIL, R. L.: Textbook of Medicine. 5th edition. W. B. Saunders Company, Philadelphia, Pa., 1942. p. 1094.
2. YATER, W. M.: Fundamentals of Internal Medicine. 1st edition. D. Appleton-Century Co., Inc., New York, 1940. p. 188.
3. STITT, E. R., CLOUGH, P. W., and CLOUGH, M. C.: Practical Bacteriology, Haematology and Animal Parasitology. 9th edition. P. Blakiston's Son & Co., Inc., Philadelphia, Pa., 1938. p. 379.
4. GORHAM, L. W.: Infectious mononucleosis, in CECIL, R. L.: Textbook of Medicine. 5th edition. W. B. Saunders Co., Philadelphia, Pa., 1942. p. 530.



A CLINICAL NOTE ON THE USE OF DESOXYCORTICOSTERONE ACETATE IN THE TREATMENT OF DUODENAL ULCER

PRELIMINARY REPORT

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Duodenal ulcer with crater was demonstrated in 529 patients at the U. S. Naval Hospital, Long Beach, California, from 1 January 1944 to 1 July 1945. The routine treatment consisted of a conservative Sippy regimen, the patient remaining in bed during the first 3 weeks of treatment.

The incidence of disappearance of the crater of an uncomplicated duodenal ulcer, when rechecked by x-ray after about 5 weeks (4 to 6 weeks) of treatment, did not exceed 25 percent.

During the month of June 1945, 17 nonhemorrhaging patients were selected at random as they were admitted to the ulcer service, and were given 10 mg. desoxycorticosterone acetate¹ intramuscularly every other day, in addition to the basic Sippy routine. Six were shown to have duodenal ulcer with crater; 6 duodenal ulcer without a demonstrable crater; 1 gastric ulcer; and 4 patients had no disease. The initial and recheck x-ray examinations were made by Commander R. G. Gates (MC) U. S. N. R. and staff, except for the 2 patients who were initially diagnosed at another activity. The case histories of the 6 patients who showed a duodenal ulcer with crater were selected for this report.

The demonstration of complete disappearance of the crater in 4 of the 6, and almost complete healing in the remaining 2 at the 5-week recheck x-ray examination justifies a preliminary report.

CASE HISTORIES

Case 1.—A carpenter's mate, second class, age 20. 15 June 1945. The duodenal bulb shows moderate deformity of the inferior surface with radiation of the mucosal folds to a central point where a tiny crater was made out, measuring not over 2 mm. in diameter. **IMPRESSION:** Duodenal ulcer with tiny crater without obstruction.

23 July 1945. Check gastro-intestinal series: There is a slight deformity of the inferior surface of the duodenal bulb but the mucosal folds appear to be normal in appearance. No ulcer crater is seen at this time.

Case 2.—A seaman, first class, age 30. 6 June 1945. The duodenal bulb shows a constriction deformity with convergence of the mucosal folds to a central point where a crater is seen. **IMPRESSION:** Duodenal ulcer with crater without deformity.

18 July 1945. Check gastro-intestinal series: The duodenal bulb again shows a constriction deformity with convergence of the mucosal folds to a central point. No crater is seen in these studies.

Case 3.—A chief quartermaster, age 31. 12 June 1945. The duodenal bulb shows a constriction deformity with convergence of the mucosal folds to a central point where a crater was seen. **IMPRESSION:** Duodenal ulcer with crater without obstruction.

17 July 1945. Check gastro-intestinal series: The constriction deformity of the duodenal bulb is again seen with radiation of the mucosal folds to a central point where the crater previously described is now reduced in size to a very small shallow area.

Case 4.—A seaman, first class, age 23. 12 June 1945. Fluoroscopic studies show a deformity of the duodenal bulb with radiation of the mucosal folds to a central point where a small crater is seen. **IMPRESSION:** Duodenal ulcer with crater without obstruction.

¹ Percorten, supplied by the Ciba Pharmaceutical Products, Inc., is Ciba's trade name for desoxycorticosterone acetate.

18 July 1945. Check gastrointestinal series: The deformity of the duodenal bulb is again seen with the mucosal folds radiating to a central point. No ulcer crater is seen in these studies.

Case 5.—A seaman, first class, age 32. Gastrointestinal series reported positive for duodenal ulcer with crater 18 June 1945, at another activity.

25 July 1945. The duodenal bulb shows a slight contour irregularity, but there is noted convergence of the mucosal folds toward a central point where a shallow craterlike fleck persists. The duodenal ulcer is apparently considerably improved but is not completely healed.

Case 6.—An aviation machinist's mate, first class, age 26. 19 June 1945. Examined at another activity. X-ray reported positive for duodenal ulcer with crater.

23 July 1945. The duodenal bulb showed a constant constriction deformity, most marked on the inferior surface with radiation of the mucosal folds to a central point. No crater was demonstrated. IMPRESSION: Old duodenal ulcer without visible crater.

SUMMARY

Six patients who initially showed a duodenal ulcer with a crater were given 10 mg. of desoxycorticosterone acetate intramuscularly every other day in addition to the basic Sippy routine. At the 5-week recheck x-ray examination, 4 showed *complete disappearance of the crater* with residual evidence of deformity of the mucosal folds (scar) and in 2, the x-ray description indicated greater than 90-percent healing of the crater.

The x-ray evidence of healing of the ulcer crater at 5 weeks was far greater in these 6 patients than could be anticipated from our previous experience, or had been witnessed in any 6 consecutive patients with demonstrable craters in the remainder of the 529 patients.

The addition of desoxycorticosterone acetate to the armamentarium of the therapy of duodenal ulcer warrants a further and extensive trial.



TREATMENT OF UREMIA WITH CONTINUOUS PERITONEAL IRRIGATION

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and

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Various attempts have been made to obtain extra renal elimination of nitrogenous waste products. It has long been appreciated that the peritoneal surfaces have great excretory powers. Foord et al. (1) showed averages of 26.6 mg./100 cc. NPN and 16.2 mg./100 cc.

urea nitrogen in ascitic fluid of hepatic cirrhosis. Myers and Keefer (2) demonstrated 0.1 to 1.7 percent total protein in ascitic fluid. Gilligan et al (3) reported 1.22 to 2.76 percent protein in ascitic fluids. Kolff and Berk (4) advocate clearance of circulating blood through an artificial dialyzing membrane of great area. Ganter and other European workers (5) (6) (7) (8) have unsuccessfully attempted to utilize the peritoneum as a dialyzing membrane. Recently Kolff (9) in the Netherlands has reported successful use of an artificial kidney by passing large quantities of the blood of a heparinized patient through an artificial dialyzing system. Two hundred and fifty grams of urea were cleared from 120 kilograms of blood passed through the system. He reported uric acid, creatinine, and indoxyl also were cleared. In March of this year Frank, Seligman, and Fine (10) in this country reported a case of uremia in acute renal failure due to sulfonamide toxicity successfully treated by the use of peritoneal irrigation. They used Tyrode's mammalian solution (sodium chloride 0.8 percent, potassium chloride 0.02 percent, calcium chloride 0.01 percent, sodium biphosphate (monohydrated) 0.005 percent, magnesium chloride 0.01 percent, sodium bicarbonate 0.1 percent and dextrose 0.1 percent) introduced by gravity and evacuated immediately by continuous suction at a controlled rate of 25 cc. per minute. Tyrode's solution was used to avoid plasma depletion of glucose and electrolytes, and to which penicillin for bacteriostasis and heparin to prevent fibrin deposition were added. They obtained urea nitrogen concentrations of 21 to 31 mg. percent in the irrigating fluid and reduced the blood NPN from 185 mg. percent to 43 mg. percent and blood urea nitrogen from 126 mg. percent to 33 mg. percent in 8 days. The patient developed peritonitis during the procedure but made an apparently complete recovery.

It is believed that this procedure will be a life-saving measure in certain cases of acute, reversible renal shutdown such as transfusion reactions, sulfonamide toxicity, toxemia of pregnancy, metallic poisoning, and acute glomerulonephritis.

We felt justified in attempting the procedure described by Frank et al. in this case of hypertension with congestive failure and nephrosclerosis because vigorous treatment of the uremia in the early course of his hospitalization had reduced the blood urea nitrogen and NPN and because at the time the technique was instituted, acute left heart failure made conventional methods of treating uremia inadvisable. From the viewpoint of elimination of nitrogenous waste products the procedure was successful; the patient did not develop peritonitis; and we now have at hand in this hospital a method of combating uremia caused by acute, reversible renal conditions.

CASE REPORT

A 52-year-old veteran was admitted 3 April 1946 seriously ill, confused and uncooperative, groaning and rolling about the bed after 3 weeks' illness; he had known hypertension for 6 months previously and 3 weeks before admission had a 14-day illness characterized by severe cough productive of copious foul, bitter, dark, sputum. The paroxysms of cough were followed by gasping and vomiting. He also had irregular palpitation, dizziness, and dyspnea. He had been given digitalis by his family physician with complete relief of palpitation and dyspnea but the nausea, vomiting, and dizziness continued, although relieved somewhat. The vomitus had been frequently "coffee ground" in appearance and the night preceding admission had contained dark brown clots. Dizziness continued and increased, accompanied by severe occipital and frontal headaches. He also complained of numbness and aching in arms, hands, and feet, saying his arms felt as if they were not his own, that he had trouble grasping objects with his left hand, and had blurring vision the day preceding admission. Since the onset of the present illness he has had frequency and nocturia three to four times and occasionally has had dull pain over the heart with radiation down the left arm. There had been a 10-pound weight loss in the past 2 months.

Family history.—Negative except that father died at age 50 years of a "stroke."

Past history.—Only serious illness was pleurisy 1 year ago. Has had nocturia one to three times for past 6 years since taking a sulfonamide for "influenza."

Physical examination.—Revealed a seriously ill, elderly man who appeared disoriented and cooperated poorly. T. 99°; P. 100; R. 16; skin warm and dry. External ocular movements up and down and to the left were poor, pupils were constricted, slightly irregular, and sluggish to light and accommodation. Fundi showed disk edema and cotton-patch exudate. Mucosa of lips parched, ENT negative. The veins of the neck were distended and pulsating. There were a few coarse, moist râles and slight decrease in resonance of the chest posteriorly at both bases. The heart was enlarged 2 cm. to the left, rhythm regular, BP 180/98. There was a loud, blowing, systolic murmur heard throughout the precardium, loudest at the apex, and a high-pitched late, diastolic murmur heard at the fifth intercostal space 2 cm. to the left of the sternal border. The liver edge was palpated 3 cm. below the right costal margin; the bladder was palpably distended. The prostate was large and boggy. The reflexes were equal and somewhat hyperactive; no definite motor weakness was demonstrated but the patient had trouble grasping and reaching for objects with the left hand.

Laboratory findings.—RBC 3,500,000; HB 10 grams; WBC 13,500, with 5 percent bands, 80 percent segmented, and 15 percent lymphocytes. Urine had 3-plus albumen and many erythrocytes and pus cells per HDF of a centrifuged specimen. Blood NPN 56.2 mg./100 cc.; B. U. N. 30 mg./100 cc.; creatinine 3.1 mg./100 cc.; CO₂ combining power 67 vol. percent; blood chlorides 445 mg./100 cc.; and Kahn negative. A lumbar puncture revealed initial pressure of 340 mm. water; clear, colorless fluid; 20 WBC. per cu. mm.; no RBC.; negative Kahn; sugar 71 mg./100 cc.; chlorides 759 mg./100 cc.; and total protein 100 mg./100 cc.

The ECG showed depressed ST2 and 3, isoelectric T 1, low T 2 and T 3, and inverted T 4. Chest x-ray showed infiltration of right lower lung field, suggesting pneumonitis. Neurological consultation advised the changes were probably on the basis of uremia. Treatment consisted of semi-erect position in bed, installation of Foley catheter, 3,000 cc, 10 percent dextrose in water by vein daily, digitalis 0.1 gram three times a day, 8.0 cc. paraldehyde as needed, and oxygen tent.

He continued on the above regimen showing little change until the third hospital day when he developed moist râles at both bases posteriorly. He was given 2.0

cc. of digalin intramuscularly four times a day. On the fourth hospital day both bases appeared consolidated and the blood NPN had risen to 84 mg./100 cc. He increased his urinary output on forced fluids on the fifth and sixth hospital days and appeared much better on the seventh day and took nourishments orally. The NPN dropped to 45 mg./100 cc. on the eighth hospital day. On the ninth hospital day he developed acute left heart failure with massive pulmonary edema but rallied with aminophyllin and restricted fluids on the tenth day. His output now averaged only 300 to 500 cc. of urine daily, peripheral edema developed and the blood NPN increased until on the fourteenth day of hospitalization it reached 297 mg./100 cc. At this time it was decided to institute peritoneal irrigation as a final effort to combat the rapidly increasing uremia.

Under local anesthesia with 1 percent procaine solution a very tiny muscle splitting incision was made high in the left upper quadrant and a mushroom catheter was inserted through this into the peritoneal cavity. A similar incision was made in the right lower quadrant just above Poupart's ligament and through this a sump drain, or sucker, of the standard type used in abdominal surgery, was inserted and passed down into the pelvis. It was secured to the abdominal wall in such a way that it could not be accidentally disturbed and also so that it could not slip so far into the abdomen as to cover the air inlet holes in the side of the drain.

After the patient was returned to the ward continuous suction was applied to the sump using an electrical suction apparatus. Fluid was instilled through the mushroom catheter at the rate of 25 cc./min. On the fifteenth hospital day and the first day after starting peritoneal irrigation the patient clinically seemed a little improved, he was more clear mentally and the headache was absent. The irrigation was working well and causing the patient only mild discomfort from distention. On the sixteenth hospital day he again developed massive pulmonary edema and a phlebotomy was performed, and aminophyllin and coramine were given. Early in the morning of the seventeenth hospital day the sump became clogged with fibrin but was cleaned out and thereafter worked well. The peripheral edema became massive by morning and the pulmonary edema failed to respond to treatment. He expired with the clinical picture of acute pulmonary edema. Table 1 shows the rise of the nitrogenous waste products in the blood before and the fall after peritoneal irrigation.

TABLE 1.—*Showing the reduction in blood NPN after beginning peritoneal irrigation on the fifteenth hospital day*

Hospital day	Blood NPN mg/100 cc.	Blood urea nitrogen mg/100 cc.	Blood creatinine mg/100 cc.	Urine output cc.	Peritoneal washings				Remarks
					Specific gravity	Urea nitrogen mg/100 cc.	Albumen	WBC/cu. mm.	
1.....	56.2			1,170					Specimen spilled by patient.
2.....	54.8	30.0	3.1						
6.....	84.0			1,625					
7.....				980					
8.....				2,300					
9.....	45.4			2,300					Left heart failure began.
10.....				1,700					
11.....				1,920					
12.....				510					
13.....	105.8		3.7	375					
14.....	171.3	157.8		420					Peritoneal irrigation begun.
15.....	297.0			600	1.005	30.1	3 plus		
16.....	126.4	96.3		450	1.006	33.8	4 plus	275	
17.....	207.0	196.0		600	1.008	45.0	4 plus	25	
18.....	189.0	148.0		300	1.005	36.6	3 plus	125	

Autopsy showed marked peripheral and pulmonary edema with 800 cc. of fluid in the left pleural cavity. The right was obliterated with adhesions of long standing. The heart was large and there was evidence of marked acute fibrinous pericarditis. Severe generalized arteriosclerosis was present and the kidney lesion was one of "nephro-sclerosis, probably arteriolar". The peritoneal cavity showed no evidence of inflammation and only a few strands of white material were present near the mushroom catheter. The pathologist described those as being deposits of chemical substance, probably a precipitate from the irrigating solution.

SUMMARY

Peritoneal irrigation was used in a patient with severe uremia in an attempt to substitute the excretory activity of the peritoneum for that of the kidneys whose function was failing. Fluid was instilled into one quadrant of the peritoneal cavity at the rate of 25 cc./min. and removed from the opposite quadrant by means of continuous suction on a sump drain.

The patient's blood urea nitrogen and NPN were reduced a significant amount although the patient subsequently died, largely as a result of a failing myocardium. The fluid removed from the peritoneal cavity contained from 30 to 45 mg. percent of urea nitrogen.

No complications arose that could be directly attributed to the peritoneal irrigation. The reduction in blood urea nitrogen and NPN in this case was sufficient that in spite of the fatal outcome we feel the procedure is to be recommended in cases of acute kidney failure where the renal function may reasonably be expected to return to satisfactory levels.

REFERENCES

1. FOORD, A. G., YOUNGBERG, G. E., and WETMORE, V.: Chemistry and cytology of serous fluids. *J. Lab. Clin. Med.* 14: 417-428, Feb. 1929.
2. MYERS, W. K. and KEEFER, C. S.: Relationship of plasma proteins to ascites and edema in cirrhosis of the liver. *Arch. Int. Med.* 55: 349-359, Mar. 1935.
3. GILLIGAN, D. R., VOLK, M. C., and BLUMGART, H. L.: Observations on chemical and physical relation between blood serum and body fluids; nature of edema fluids and evidence regarding mechanism of edema formation. *J. Clin. Investigation* 13: 365-381, May 1934.
4. KOLFF, W. J. and BERK, H. T. J.: Artificial kidney: dialyser with great area. *Acta med. Scandnav.* 117: 121-134, 1944.
5. GANTER, G.: Ueber die Beseitigung giftiger Stoffe aus dem Blute durch Dialyse. *München, med. Wchnschr.* 70: 1478-1480, Dec. 14, 1923.
6. ROSENAK, S. and SIWON, P.: Experimentelle Untersuchungen ueber die peritoneale Ausscheidung harnpflichtiger Substanzen aus dem Blute. *Mitt a. d. Grenzgeb d. Med. u. Chir.* 39: 391-408, 1926.
7. von JENEX, E.: Kann das Bauchfell bei Urämie die Rolle eines natürlichen Dialysators übernehmen? *Ztschr. f. klin. Med.* 122: 294-305, 1932.
8. BALÁZS, J. and ROSENAK, S.: Zur Behandlung der Sublimatanurie durch peritoneale Dialyse. *Wien. klin. Wchnschr.* 47: 851-854, July 6, 1934.

9. **KOLFF, W. J.:** Blood dialysis as a method of treatment for uremic and anuric conditions. *Nederlandsch tijdschrift voor geneeskunde*, as reported in *J. A. M. A.*: 130: 1259, Apr. 27, 1946.
10. **FRANK, H. A., SELIGMAN, A. M., and FINE, J.:** Treatment of uremia after acute renal failure by peritoneal irrigation. *J. A. M. A.* 130: 703, Mar. 16, 1946.

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PRIMARY LIPOSARCOMA OF BONE

REPORT OF A CASE

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The discovery of a primary bone liposarcoma is an extremely uncommon occurrence (1). In view of the rarity of this lesion, additional studies of cases in which primary liposarcoma of bone is suspected and in which postmortem examination has been done constitute desirable and necessary additions to the literature on the subject. The present case report is submitted with such a thought in mind.

CASE REPORT

The patient, a 31-year-old white seaman, was admitted to the hospital on 1 July 1944 complaining of pain and stiffness in the lumbosacral area. He stated that he had first noted pain in the back as a result of lifting an aircraft propeller while in service school several weeks previously. The pain which resulted from this incident was trivial and transitory. Subsequently, however, he did note that coughing or straining led to a momentary, sharp pain in the lower lumbar area. About 4 days prior to admission he developed a dull generalized lumbosacral pain which followed the onset of a cold. This pain had become partially incapacitating and led to his admission to the sick list. In addition to the low back pain, about a month prior to admission he had noted the onset of generalized weakness, and, during the past several months, had lost about 15 pounds in weight.

A review of the symptoms brought out no other significant complaints.

The *past history* and the *family history* were considered to be noncontributory.

Physical examination revealed a well-developed, fairly well-nourished, white male weighing 160 pounds. He turned himself in bed cautiously and appeared to be having some pain in the lumbosacral area. There was evidence of muscle

spasm in the lumbar region bilaterally associated with localized tenderness over the lower lumbar and both sacro-iliac areas. Straight leg raising resulted in a moderate degree of lumbar pain. However, the hip joints themselves were freely movable. Careful examination of the prostate revealed no abnormality. The physical examination otherwise was not remarkable.

Laboratory findings upon admission revealed the hemoglobin to be less than 7.5 gms. percent; the RBC was 1,600,000 per cu. mm. of blood; the WBC was 8,100 per cu. mm. of blood, with 14 percent band forms, 54 percent segmented forms, 28 percent lymphocytes, and 4 percent eosinophiles. Morphologically the anemia appeared to be of a hypochromic, microcytic type. There was no morphologic evidence to support the presence of leukemia. The serum phosphorus measured 4.0 mg. percent. The sedimentation rate of the blood was 11 mm. in 1 hour. The urinalysis was negative. A qualitative test of the urine for calcium indicated the presence of increased calcium excretion. No Bence-Jones protein was detected in the urine. The basal metabolic rate was minus 12 percent. An intradermal skin test with coccidioidal antigen was negative. The Kahn precipitation test of the blood was negative.

Radiographic examinations of the dorsal and lumbar spine, the skull, and both thighs and legs were interpreted as being within normal limits. An intravenous

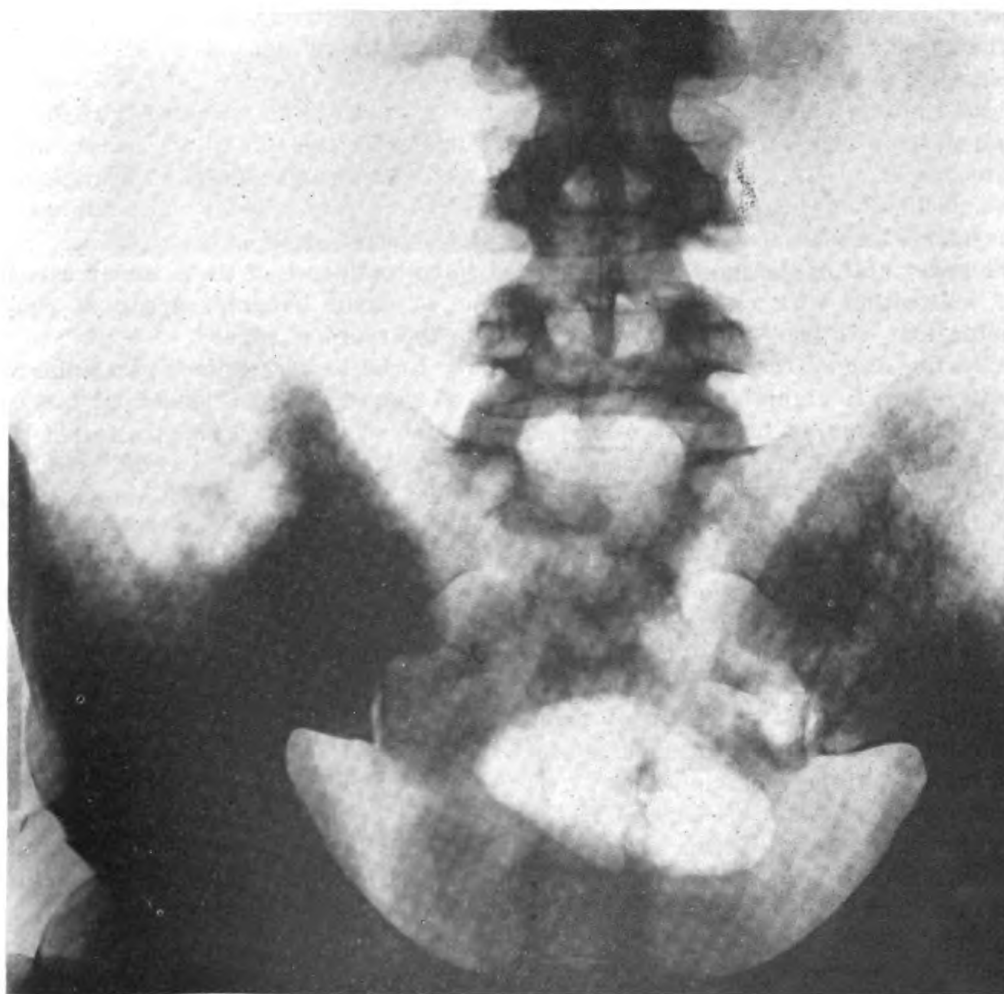


FIGURE 1.—Primary liposarcoma of bone.

pyelogram was not remarkable. Examination of the chest revealed prominent pulmonary markings throughout the entire right lung. However, no definite evidence of metastasis or parenchymal infiltration could be made out. The thoracic cage appeared normal. Examination of the pelvis stereoscopically revealed a diffuse, irregularly distributed, predominantly osteolytic lesion involving the sacrum, the upper two-thirds of the ilium bilaterally, and, to a lesser extent, both pubic bones. Associated with the areas of bone destruction irregular areas of osteoblastic activity were noted. The osteolytic and osteoblastic processes combined to give the bone a mottled appearance. These findings were initially interpreted on the basis of a metastatic malignancy of undetermined origin (fig. 1).

Pathological findings.—On 22 July a biopsy specimen was removed from the posterior margin of the left ilium. The pathological report was as follows: "Sections of ilium show a bony structure having marrow which contains multiple islets of epithelial-appearing cells. These have small, deeply staining nuclei with a distinct, pale, watery cytoplasm. In some areas, cells have a signet-ring appearance and cytoplasm is vesicular. No mitoses are seen. Diagnosis: Bone marrow infiltration by lipoid-appearing cells. Possible lipoid dyscrasia." The sections were not stained with sudan III.

Treatment.—The patient was treated symptomatically, attempts being made to combat the anemia. Three hundred thousand units of penicillin were administered intramuscularly between 28 July and 5 August. Subjectively he improved somewhat. On 3 August the RBC measured 3,050,000 per cu. mm. of blood, and the hemoglobin was 9.5 gram percent.

Reexamination of the chest roentgenologically on 4 August revealed that there had developed a moderately large convex shadow at the left hilum which was interpreted on the basis of metastasis to the hilar lymph nodes. Throughout the medial two-thirds of the right lung field there was noted a very fine parenchymal infiltration which presented a peribronchial type of distribution. In the lower half of the lung there was noted some confluence of these linear areas of infiltration with the resultant formation of small irregular areas of consolidation. No bony metastasis was noted in the thoracic cage.

During August the patient appeared slowly to be losing ground, particularly with regard to his weight and strength. On 25 August the RBC measured 1,980,000 per cu. mm. of blood. Repeated examination of the blood smears failed to reveal significant changes in the morphology of the white blood cells. On 24 August he was placed on stilbesterol, 1 mg. daily. On 28 August, after receiving 350 cc. of citrated blood, he developed a slight chill which necessitated termination of the transfusion. He had a moderately severe reaction following the transfusion, his temperature reaching 104° F. 10 hours later. However, the following day his general condition appeared satisfactory and he was afebrile.

On the morning of 30 August the attending physician noted numerous petechiae and areas of ecchymosis of generalized distribution over the skin and visible mucous membranes. At noon of that day signs of a cerebrovascular accident, without definite localizing signs, appeared and the patient expired 8 hours later without regaining consciousness.

Post-mortem findings.—GROSS: The body is that of an emaciated, white male, 31 years of age. The lower lobe of the right lung is involved in early pneumonic consolidation. The remaining lung tissues appear full and have a soft, bluish tint which persists throughout the lung structure.

Lymphadenomatosis is marked in the common iliac and aortic lymphatics. The lymph nodes are discrete, firm, and on gross section show a central bluish tint which gradually fades in transition to grayish surface tissue.

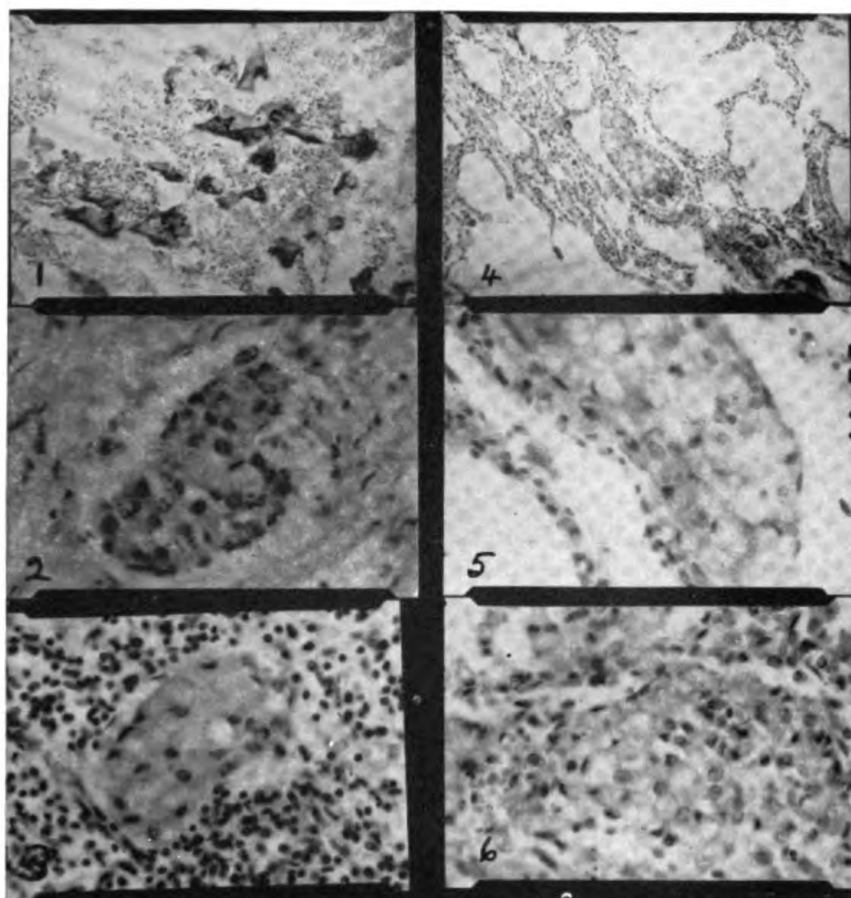


FIGURE 2.—Liposarcoma, bone marrow (primary).

- | | |
|-------------------------------|-------------------------------|
| 1. Bone marrow $\times 100$. | 4. Lung $\times 100$. |
| 2. Kidney $\times 440$. | 5. Lung $\times 440$. |
| 3. Lymph gland $\times 440$. | 6. Bone marrow $\times 400$. |

The iliac muscles appear sallow and glistening. This feature is more pronounced in the left iliac region at which site 15 to 20 cc. of light, yellowish-amber, clear, liquid fat are found between muscle fascia and periosteum. The internal surface of the left iliac bone shows a finely grayish, mottled surface, dominant centrally and adjacent to the left sacro-iliac synchondrosis. At this site the bone is easily punctured with knife-point pressure. The bone marrow of the ilium is smoky-gray and presents a finely nodular appearance.

Recent hemorrhage and blood-clot formation, 4 cm. in diameter, are present in the deep structure of the mid-parieto-occipital region of the left cerebrum.

MICROSCOPICAL: Examination reveals neoplastic tissue in the bone marrow, lymph nodes, lungs, and right kidney. Neoplastic cells vary from polygonal granular cells with central, rounded, vesicular nuclei to rounded cells with marginal, crescent-shaped nuclei, and other cells with nuclear elongation and cytoplasm of fibroblastic nature. Cellular demarcation is good to undeterminable, and all cell types are often present within a single small neoplastic cell mass. Mitosis is rare. The neoplastic cell masses are both compact and loose, and vary in size and shape. Centrally, some of the cell masses show a watery or pseudo-mucinous-like degeneration in which faint cell outlines remain.

Sudan III stain for fat shows many of the large granular polygonal cells to possess a finely globular fat. The globular fat-like cells with marginal crescent-shaped nuclei stain as a single fatty mass, while the fibroblastic-like cells are without fat. Cells of some of the neoplastic groups accept the fat stain generally, while other groups, more commonly found, show scant to no cellular acceptance.

The bone marrow shows demarcated and non-demarcated neoplastic cell patches irregularly dispersed through a cancellous bone structure. A single flat endothelial cell layer surrounds many cell groups and often red blood cells are noted between the demarcated neoplastic cells and the surrounding endothelial structure. Bone marrow cells are present including osteoblasts and osteoclasts. No tumor giant cells are found.

Lymph nodes show fibroblastic replacement, disseminated small lymphocytes, absence of germinal centers and neoplastic cell groups within an endothelial lined demarcation. Areas of the fibroblastic replacement possess a hazy pseudo-mucinous intercellular substance.

The lungs are diffusely involved with cell groups identical to the foregoing descriptions. The cell nests are adjacent to bronchioles and within interalveolar septa. Here, as in other tissues, the cell groups fill the surrounding endothelial spaces.

Two small tumor sites are noted within a dense fibrous stroma in tissue from near one calyx of the right kidney. The neoplastic cytology is identical to that generally described (fig. 2).

COMMENT

Our position in reporting this case as one of primary liposarcoma of bone is analogous to that of Stewart (2) who admitted that he was in doubtful territory in placing his three cases in this category. The pathologic evidence led us to the conclusion that the primary site of this neoplasm was the fibrous reticulum of bone marrow in which the physiological fatty change had been retained within an otherwise neoplastic response.

The radiologic aspects of the case deserve a word of comment. From the diagnostic standpoint, Barnard's patient, who was considered to have a primary liposarcoma of bone, presented a destructive lesion in the region of the greater tuberosity of the humerus (3). In one of Stewart's cases (case 3) the lesions involving the femur, parietal bone, one rib, and the dorsal spine had been interpreted roentgenologically as multiple myeloma prior to the patient's admission to the hospital. The x-ray findings of the bone in our case presented no particular features which might not be produced by a predominately osteolytic metastatic carcinoma. The lesion was so interpreted initially, and a review of the films following the post-mortem examination brought to our attention no features which would lead to a different interpretation should a similar situation be encountered. The chest findings also presented no peculiarities which would give a clue as to the nature of the underlying metastatic malignancy.

Stewart has reported that the lesions considered by him to be liposarcoma of bone were radiosensitive. Our patient was not subjected to radiation therapy.

The underlying cause of the hemorrhagic tendency which our patient developed as a terminal event was not determined.

SUMMARY

A diffuse bone tumor involving the pelvis with metastasis to regional lymph nodes and the chest is reported. Pathologically the lesion was considered to represent primary liposarcoma of bone.

REFERENCES

1. EWING, J.: *Neoplastic Diseases*. 4th edition, revised. W. B. Saunders Co., Philadelphia, Pa., 1940. p. 202.
2. STEWART, F. W.: Primary liposarcoma of bone. *Am. J. Path.* 7: 87-94, March 1931.
3. BARNARD, L.: Primary liposarcoma of bone. *Arch. Surg.* 29: 560-565, October 1934.



GONORRHEAL ENDOCARDITIS

REPORT OF A CASE

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It is the purpose of this paper to report a case of gonorrheal endocarditis in which an extensive clinical, bacteriological, and pathological study has been made and which fulfills those criteria established by Karsner (1) as necessary before any case of endocarditis can be definitely attributed to the Neisserian gonococcus. Karsner stated that "a case of gonorrheal endocarditis must show the presence of gonococci in the blood or lesion to be accepted as such."

In 1922 Thayer (2) published a classic on the subject and reported a total of 327 cases of endocarditis, of which only 20 were proven to be due to the gonococcus. Since his paper with its review of the literature to that date only a few more have been definitely authenticated in the entire literature, so that today there are only about 150 cases reported.

These should become even more infrequent now that the treatment of gonorrheal urethritis has improved so much with the introduction of the sulfonamide and antibiotic groups of drugs.

The case reported here is presented in some detail as it developed clinically because of the various diagnostic problems it presented and to show the evolution of signs and symptoms.

CASE REPORT

A 26-year-old Marine sergeant of Greek extraction was admitted to the U. S. Naval Hospital, National Naval Medical Center, Bethesda, Md., on 27 March 1943 with a chief complaint of chills and progressive weakness of 4 days' duration. The history revealed that 1 month prior to admission, after a strenuous basketball game, he had experienced a severe shaking chill. He developed a sore throat and fever and was finally hospitalized for catarrhal fever which was later complicated by bronchopneumonia. After a stay of 2 weeks he was discharged to duty well. On the morning of discharge he fainted and in the evening had chills. While on 4 days' leave he had chills every day and twice on some days. He continued to feel weak and fainted again. The chills continued following readmission and were accompanied by fever and profuse sweating. On this admission he complained of tenderness and pain on the plantar surface of the left foot at the third metatarsophalangeal joint. The past medical history was entirely non-contributory, except for gonorrheal urethritis 3 months prior to admission. This apparently was adequately treated with sulfathiazole therapy and the discharge cleared up in 1 week's time. Since then the patient has been free of discharge and urinary symptoms. Family history was completely negative.

Physical examination.—A white male of 26, weighing 160 pounds, well developed, but showing obvious signs of recent weight loss, and considered to be poorly nourished by the examiner. Temperature: 102° F.; pulse: 130; respirations: 20; blood pressure: 98/70. Face haggard and sunken in appearance, skin sallow, lips cyanotic. The physical examination was negative, except for a palpable spleen, somewhat tender, enlarged to four centimeters below the costal margin. No lymphadenopathy. Moderately marked clubbing of the fingers. An area of tenderness in the plantar surface of the left foot beneath the center of the transverse arch. A diagnosis of malaria was made pending further study.

The following studies were made: Routine CBC, blood Kahn, malaria smear, urinalysis, blood culture, but as all proved to be negative, further studies were ordered. In all the following laboratory findings were obtained: Repeated blood cultures, a total of 14 in all, were negative; x-rays of chest, sinuses, a pyelogram, and G. I. series were all essentially negative; Widal test, negative; brucellergin skin test, negative; agglutinations for paratyphoid, negative; tularemia test, negative; stethocardiogram showed evidence of systolic and diastolic murmurs over the apex, and prostatic smears, negative.

Clinical course is outlined as follows:

- 2 April—Splenic dullness increased. Beginning generalized lymphadenopathy, discrete, nontender with marked, bilateral inguinal adenopathy. Running a septic fever with chill.
- 8 April—Sharp constant pain in left lower quadrant of abdomen. Pain moved to left upper quadrant in few hours. Blood culture taken 2 April reported as negative.
- 11 April—Left lower quadrant pain no longer present.
- 13 April—Pain in anterior triangles of neck. Anterior cervical lymphadenopathy, tender, discrete nodes. A typical raised, red, circumscribed butterfly shaped eruption appeared over the nose and upper cheeks. Infra-orbital areas moderately edematous. No petechiae. Fundi negative. Impression: Erysipelas.
- 15 April—Eruption over face disappearing. Running septic-type fever.
- 20 April—Pain in left palm of hand, voluntary splinting noted. Red, swollen, tender, hot and painful area in palm of left hand. Thought to be an Osler's nodule.

- 22 April—Nodule in hand still present. Pain diminished. A soft systolic murmur with a questionable low rumbling late diastolic murmur heard in apical area. Impression: Subacute bacterial endocarditis.
- 23 April—Murmur no longer heard.
- 27 April—Violent chill. Given 500 cc. of whole blood.
- 28 April—Another chill. Vague pain in right flank. Moderately loud systolic murmur at apex.
- 8 May—Murmur at apex loud and blowing. Red cell count at 2,680,000. Fever therapy by Kettering cabinet started.
- 12 May—Diastolic murmur heard for first time since 22 April.
- 14 May—Apical systolic murmur present, but softer than previously. Diastolic murmur absent.
- 18 May—Blood transfusion. Eight consecutive daily typhoid vaccine fever therapy treatments completed.
- 20 May—Bilateral lumbar pain and tenderness in all leg muscles.
- 21 May—Sulfadiazine therapy discontinued.
- 24 May—Severe chill.
- 26 May—Definite diastolic murmur at apex. Transfusion with 500 cc. of whole blood followed by mild reaction.
- 27 May—Tender, warm, painful nodule in palm of right hand.
- 29 May—Numerous petechiae in left antecubital fossa.
- 31 May—Severe sudden sharp pain in right leg with numbness in right leg. Right leg definitely cooler than left leg and right thigh. Dorsalis pedis and posterior tibial pulsations absent. Partial analgesia over dorsum of right foot and lower anterior third of right leg. Impression: Embolic occlusion of right femoral artery.
- 2 June—Apical murmur now definitely to-and-fro in character. Right leg much improved.
- 7 June—Herpes labialis and ocularis. Leg now warm and of normal color.
- 9 June—Chill.
- 14 June—Several large transient purple splotches on right lower leg and foot which disappear upon change in position of leg.
- 17 June—Marked pitting edema over both ankles. Icteric hue to skin.
- 19 June—Red cell count: 1,500,000. Transfusion followed by reaction.
- 20 June—Profuse epistaxis. Very weak. Four-plus pitting edema of ankles.
- 21 June—Edema persisting in ankles, beginning to develop in wrists, none over sacrum.
- 22 June—Moderate cyanosis developed. Respirations rose from 24 to 50 per minute and finally ceased. Pronounced dead.

Treatment.—The patient during life received quinine as a presumptive therapeutic test for malaria. He was given a total of 79 grams of sulfadiazine during the course of his illness. Several transfusions of citrated whole blood were given. Three hyperthermia treatments in the Kettering cabinet were tried. The patient reacted unfavorably to the third and so they were discontinued and a course of 8 intravenous typhoid fever treatments was instituted. Fevers of 104° F. and above were obtained and attempts, not wholly successful, to maintain them at that level were made.

Postmortem report.—The body is that of an emaciated, icteric 26-year-old white male weighing about 125 pounds. There are numerous petechiae over the dorsal surface of both feet. LUNGS: Hypostatic congestion of both lungs. No infarcts or consolidation. HEART: Right heart is distended with blood. Heart is normal in size, but flabby. No infarcts or roughening of the epicardial sur-

face. The endocardium is uniformly smooth throughout all the chambers, except for the leaflets of the mitral valve and the endocardial surface of the left auricle just above the mitral valve. Here are found papillary excrescences of gold-orange to brown colored vegetations. It is a characteristic florid bacterial endocarditis. The vegetations also extend down on the chordae tendineae to the papillary muscles which are beginning to be eroded by the bacterial process. They form a thick shaggy coating. The foramen ovale is not patent and there are no congenital defects. A few septic infarcts are present in the wall of the epicardium and extend into the myocardium. The vegetations are mainly to the left and anterior side of the mitral orifice. Beneath the vegetations the valve shows an old thickening. **ABDOMINAL CAVITY:** The liver extends down 10 centimeters below the costal margin; the spleen 4 centimeters. The spleen weighs 660 grams, and it contains multiple septic infarcts. The cut surface is yellowish-red and several infarcts which are seen on the surface extend into the pulp. Some large lymphnodes are present in the pelvic ridge and a general lymphadenitis is noted. The liver weighs 2190 grams and capsule is smooth, with margin rather sharp. Sectioning shows fatty change. Kidneys are slightly paler and larger than normal. Left has a constriction around the middle and some depressed scars. Minute petechiae are present beneath the stripped capsule of the left. Both show multiple infarcts. **FEMORAL ARTERY:** There is a mural thrombus practically occluding the lumen of the right femoral artery which extends 15 centimeters below Poupart's ligament.

Microscopic examination of heart.—The section through the myocardium shows acute granular degeneration of the muscle fibers with disappearance of the striatal margins. Sections through the mitral valve leaflets show linear streaks of deep-blue staining masses of bacteria which are separating the muscle fibers and destroying many of the bands. The exuberant growth along the mitral valve margins is composed of necrotic exudate containing many partially degenerated polymorphonuclear leukocytes enmeshed in fibrin. Many bacteria noted in lesion.

Bacteriology.—Blood was taken from the superior vena cava and from the spleen under sterile technique. The blood was plated onto a 1 cubic centimeter blood plate, 2 cubic centimeter blood plate, Brewer's medium, and blood culture tubes. Eight hundred sixty colonies grew on the blood agar plates. These were shown to be Gram-negative diplococci. From heart's blood and spleen diplococci were grown in pure culture and then run through sugar differentiation tests for Gram-negative diplococci. All showed the same characteristic morphology, culture characteristics, and sugar reactions for *Neisseria gonorrhoeae*. Bacteriologic diagnosis: *Neisseria gonococcus*.

Bacteriologic diagnosis.—*Neisseria gonococcus*.

Final diagnosis.—Acute ulcerative bacterial endocarditis due to *Neisseria gonorrhoeae* with septicemia and multiple emboli.

REFERENCES

1. KARSNER, H. T.: Pathology of endocarditis; summary review. *J. A. M. A.* **96**: 411-417, Feb. 7, 1931.
2. THAYER, W. S.: Cardiac complications of gonorrhea. *Bull. John Hopkins Hosp.* **33**: 361-372, Oct. 1922.
3. WILLIAMS, R. H. Gonococcic endocarditis; study of 12 cases, with 10 post-mortem examinations. *Arch. Int. Med.* **61**: 26-38, January 1933.
4. KIRKLAND, H. B.: *Gonococcus* endocarditis; report of case. *Am. Heart J.* **7**: 361-370, February 1932.
5. STONE, E.: Gonorrheal endocarditis, *J. Urol.* **31**: 869-895, June 1934.

TROPICAL LICHEN PLANUS—NEW GUINEA VARIETY

Tabulation of the pertinent clinical data:

1. All patients studied were returned from New Guinea.
2. The age factor was unimportant.
3. Two gave a history of having had a mild form of lichen planus in the United States prior to arrival in New Guinea. The eruption in each case became worse overseas.
4. History of grief and long-continued anxiety prior to onset of illness was elicited in 20 patients.
5. Many complained of overwork, insomnia, and malaise.
6. Dietary imbalance affected all with weight loss, varying from 10 to 45 pounds.
7. The majority of patients became ill in from 3 to 6 months after arrival in New Guinea from the United States.
8. The onset was insidious and unaccountable. Generalized spread occurred in from 2 to 3 weeks.
9. Sites of predilection were the hands, feet, face, and scalp.
10. Eyelids and lips were involved in most of the patients.
11. The fingernails were dystrophic in 50 percent of the cases.
12. The eruption was atypical and extensive, resembling dermatitis exfoliativa, psoriasis, and eczema.
13. Lesions varied in color from erythema to violet to bluish-black.
14. There was partial alopecia of scalp, eyebrows, axillae, and pubis in most of the cases.
15. Residual pigmentation and atrophy were present in all cases.
16. The skin was sensitive to temperature changes. Patients were uncomfortable in warm weather and fairly comfortable in cool weather.
17. Pruritus was variable.
18. The liver was enlarged one to three finger-breaths in 8 patients. Liver function tests, however, were negative.
19. Improvement in hospital was attributed to mental ease, better nutritional intake, supplementary vitamins, psychotherapy, and crude-liver-extract injections.

Authors' conclusion.—A study of 24 patients returned from the New Guinea area with generalized lichen-planus-like eruption was made at Rhoads General Hospital. That all patients studied were in a state of nutritional deficiency was without question. That many patients were in a state of endocrine exhaustion can be postulated because of the nutritional deficiency, the extensive alopecia, and the temporary loss of libido. Whether or not the vitamin-enzyme-hormonal factors served as predisposing factors in the susceptible individual is to be determined. Just what is the exciting factor in the causation of the disease is speculative. The possibility of a viral infection is tenable and further study will detract or lend support to this concept. The role of atabrine in this disease is discussed for further study.—DANTZIG, L., and MARSHALL, L. E.: Tropical lichen planus—New Guinea variety; clinical report on 24 cases. New York State J. Med. 46: 991-995, May 1, 1946.



MEDICAL AND SURGICAL DEVICES



AN APPARATUS FOR THE REDUCTION OF FRACTURES OF THE WRIST AND FOREARM

WALTER A. GUNTHER

Lieutenant Commander (MC) U. S. N. R.

and

NATHANIEL T. HOLZER

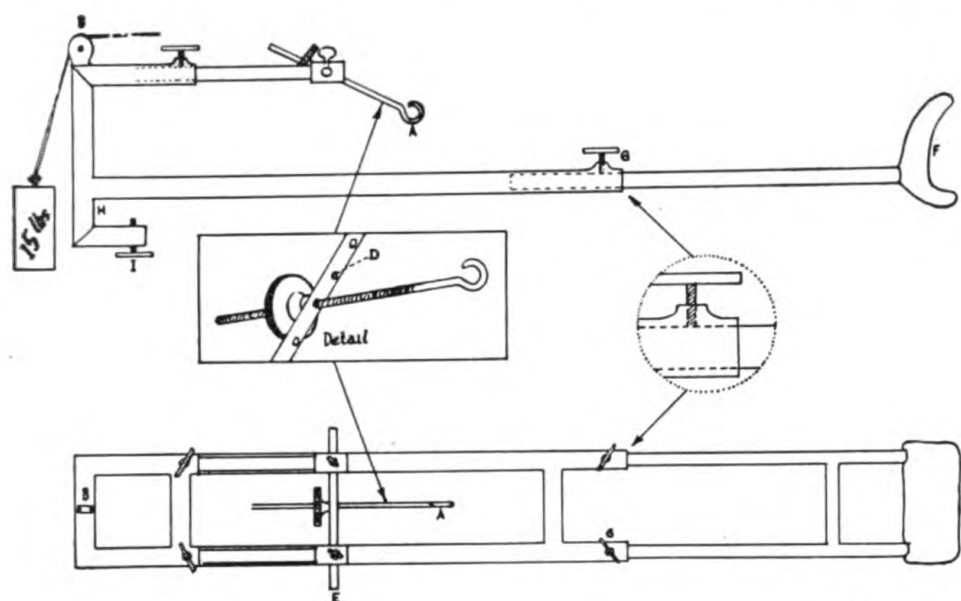
Pharmacist's Mate, third class, U. S. N. R.

The standardization of the treatment of common fractures is a desirable end in all surgical practice. It is particularly to be desired in naval hospitals where the rapid turn-over of professional personnel throws the burden of the treatment of trauma on many shoulders in a comparatively short time. It enables occasional operators to achieve results approaching those of men especially trained in fracture work. An effort has been made at this institution to bring about a certain amount of this standardization.

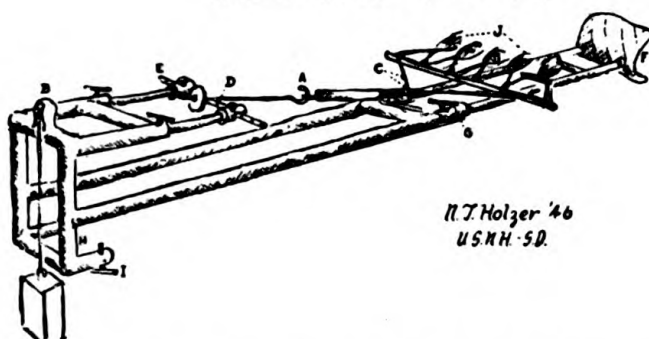
One of the most common fractures of long bones in adults is that first described by Abraham Colles in 1814 and since known as Colles' fracture of the radius. The apparatus illustrated (fig. 1) was designed especially to treat this affection and consists essentially of a padded rest (F) for the upper arm, connected by telescoping metal bars (G) to a fixed point several feet distant (H). The whole is fastened securely to a plain wooden examining table by the metal thumbscrews (I). The patient, lying on his back, has the biceps of his injured arm against the rest with the elbow flexed to 90 degrees and the forearm parallel to the long axis of the body.

The fingers, after being protected by adhesive tape, are placed in wire finger "traps" (J). Traction is made on the arm either by a calibrated spring attached to the traps and fastened at point (A), or by a free-hanging weight over pulley (B). The finger traps and spring are of an ordinary commercial manufacture. The remainder of the apparatus is made of scrap metal and can readily be constructed at any naval establishment.

At this hospital most fresh Colles' fractures are reduced under local anesthesia. This is introduced after the patient has been arranged



*Traction Apparatus for
Lower Arm Fractures*



*R. J. Holzer '46
U.S.M.H. 50.*

FIGURE 1.—Diagram of traction apparatus for lower-arm fractures.

in the device but before traction is applied. After the fracture site and the hematoma have been infiltrated with 2 percent procaine solution, 15 pounds of traction is applied for 15 minutes. This can be done either with the spring traction or by means of the weight and pulley. The latter method is not shown in the accompanying photographs but it is probably best as it is more accurate and constant. Ulnar deviation of the hand can be achieved by eccentric application of the wire (C) to the hook and spring. Also, by applying traction through one of the more lateral holes (D) in the rod (E).

While the traction is acting, impaction of the fracture can be felt and often seen to be overcome. One of the chief advantages of the method is the gentle means by which the dis-impaction may be accom-

plished in contrast to the usual "whipsawing" of the wrist seen so often in manual reductions. At the end of 15 minutes the result is checked by palpation. Any remaining dorsal tilt of the distal fragment is corrected by the thumbs of the operator. A plaster of paris splint, 12 sheets thick and padded with 4 thicknesses of sheet-wadding is applied from the heads of the metacarpals to the elbow on the extensor side of the arm. As the traction is gradually released, the operator molds the splint to the extremity, forcing the hand in ulnar deviation and moderate volar flexion. The splint is secured with elastic cotton bandage, leaving the thumb and fingers free. After check-up x-rays have shown a satisfactory reduction, the immobilization may be strengthened by the addition of a circular plaster-of-paris bandage.

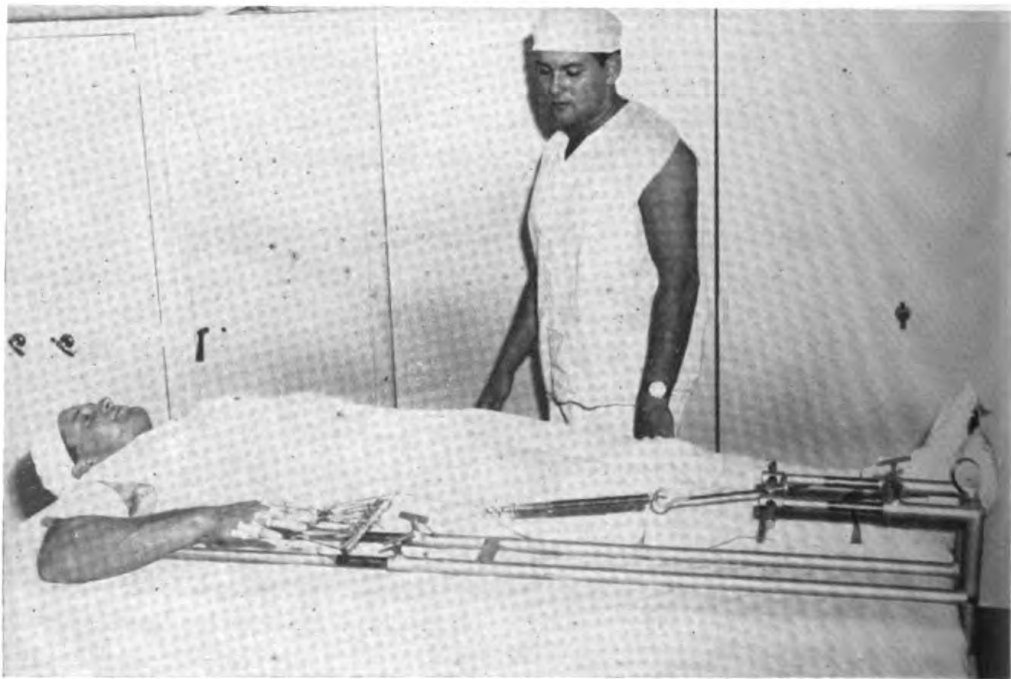


FIGURE 2.—Traction apparatus for lower-arm fractures with spring traction in use.

This apparatus is also valuable in the reduction of "reversed" Colles' or Smith fractures, displacement of the lower radial epiphysis in children, and in certain dislocations of the carpus. It is especially useful in overcoming muscle spasm in fractures of both bones of the forearm.

BIBLIOGRAPHY

JOLDERSMA, R. D.: Symposium on war surgery; traction reduction of fractures about wrist. *S. Clin. North America* 23: 1613-1622, Dec. 1943.

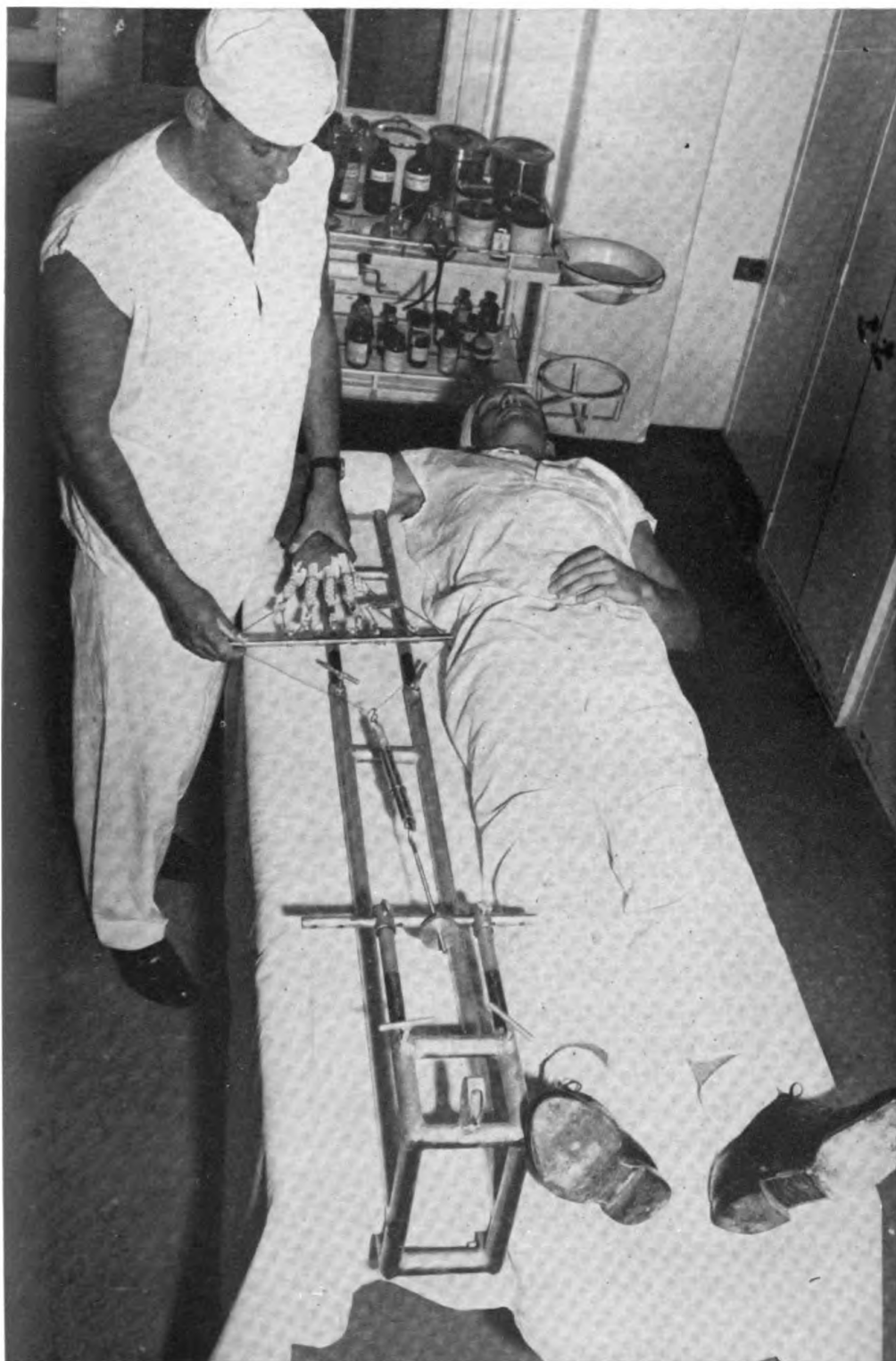


FIGURE 3.—Traction apparatus for lower-arm fractures with spring traction in use.

BOOK NOTICES



Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,

Bureau of Medicine and Surgery, Navy Department,

Washington 25, D. C.

(For review)

DISEASES OF THE RETINA by *Herman Ellwyn, M. D., Senior Assistant Surgeon, New York Eye and Ear Infirmary.* 587 pages; illustrated. The Blakiston Co., Philadelphia, Pa., 1946. Price \$10.

This text is of value to the general practitioner as well as to the specialist because it correlates retinal disease with systemic disease, especially vascular and central nervous system disorders.

It is composed of seven parts. Part I deals with "Diseases of Retina Resulting from Disturbances in Circulation," and is valuable reading for any physician. It deals with arteriosclerosis of the retinal vessels and angiospastic retinopathy as seen in essential hypertension. The complex of changes in the retina is discussed under the term arteriospastic retinitis, and is followed by a discussion of the diseases of which it forms a part; glomerulonephritis, eclampsia, malignant renal sclerosis and rare forms of renal disease as amyloid contracted kidney, polycystic kidney, etc. The retinal changes in diabetics will be of especial interest to the internist as also will be the changes described in disease of the blood such as anemia, leukemia, etc.

A clear clinical picture is presented of each disease entity with a full description of the pathologic anatomy. The best methods of treatment are given, including pharmaceutic and operative measures.

The other parts are:

Part II, Diseases of the Retina Resulting from Vascular Malformation; Part III, Degenerative Diseases of the Retina on a Hereditary Basis; Part IV, Inflammatory Diseases of the Retina; Part V, Tumors of the Retina; Part VI, Diseases of the Retina Leading to Retinal Detachment; Part VII, Developmental Anomalies of the Retina; Part VIII, Radiation Injuries of the Retina.

These parts are of more interest to the ophthalmologist.

This is the first complete work on retinal diseases to appear in more than 30 years and should be a part of every ophthalmologist's library. It also is a worth-while book for the internist and general practitioner.

PREVENTIVE MEDICINE AND PUBLIC HEALTH by *Wilson G. Smillie, A. B., M. D., D. P. H., Sc. D. (Hon.)*. 607 pages, The Macmillan Co., New York, publishers, 1946. Price \$6.

This is a new book in scope and approach, designed mainly to introduce a point of view to the student of medicine that will orient his thinking in future practice along sound lines in preventive medicine and public health. The author adopts the thesis that the physician in practice has an obligation to his patients and to his community to prevent illness and to promote family and community health. He is to be congratulated for so effectively presenting this viewpoint in his initial attempt.

While much of the detail found in usual texts is omitted, there is sufficient specific information on preventive measures and techniques as well as use of illustrative case histories to avoid the weakness of vagueness and generalities. Most of the emphasis is placed on the physician's responsibility in the care of the health of his patient. Frequent reference is made to opportunities for educating individuals and the community in health conservation.

This subject matter is organized into six sections. The introduction contains a clear statement of viewpoint and definitions, and a rather long attempt to simplify statistics which goes into more detail than most students will find profitable. The other five sections deal with environmental sanitation, communicable disease control, child hygiene, adult health protection and promotion, and public health administration. This material is well presented for consumption by the medical student, and by practicing physicians who desire an orientation that will make them more effective guardians of individual and public health.

PEPTIC ULCER, ITS DIAGNOSIS AND TREATMENT, by *I. W. Held, M. D., F. A. C. P.; and A. Allen Goldbloom, M. D., F. A. C. P.* 382 pages, illustrated. Charles C. Thomas, Springfield, Ill., publishers, 1946. \$6.50.

Peptic ulcer is a big problem confronting the practicing physician and especially the military medical men. This volume is compact and in about 300 pages, gives a complete review of the ulcer problem with a very interesting chapter on "The Dyspeptic Soldier." We must all remember, however, that the same types of personnel have peptic ulcers in civilian life and the problem of their management is much the same. Unless a clinician pays considerable attention to the psychologic factors and those of stress or conflict, little ultimate

good will be accomplished in the treatment of an ulcer for, by permitting such conditions to continue, the recurrency of the ulcer is assured. This is one situation where the treatment of "the patient" is the most important. This volume pays some attention to these factors. The book is well arranged and presents its subject in good sequence. Like many subjects in medicine, the authors have developed their manuscript according to their own method of practice. They still include information about the work of other physicians, to make it a useful reference in a condensed form.

THE TRAUMATIC DEFORMITIES AND DISABILITIES OF THE UPPER EXTREMITY, by *Arthur Steindler, M. D., F. A. C. S., Professor and Head of the Department of Orthopedic Surgery, The State University of Iowa. In collaboration with John Louis Marxer, M. D., Associate, Orthopedic Department, The State University of Iowa.* 494 pages, 443 illustrations. Charles C Thomas, Springfield, Ill., publishers, 1946. Price \$10.

This attractive, excellent book is a credit to the authors and the publisher. It is well bound and with type pleasantly easy to read printed on high gloss paper.

As stated by the author, this work is presented in the form of a case book rather than that of a text, in view of the fact that the material is too great, too varied and diversified to be adequately covered by any one specialist's experiences.

It is divided into two parts: Part A, General Consideration Pertaining to Traumatic Disabilities of the Upper Extremity; covering, Traumatic Deformities of Upper Extremity and Restoration of Form, Restoration of Function, Pain Factor in Traumatic Disabilities of Upper Extremity, and General Surgical Principles Applying to Upper Extremity. Part B, Special Part; covering, Traumatic Disabilities of Shoulder Girdle and Arm, Traumatic Disabilities of Elbow Joint, Traumatic Disabilities of Forearm and Wrist, and Traumatic Deformities of Hand and Fingers.

The 494 pages are profusely illustrated by 443 photographs, figures, and drawings, which closely follow the printed version and easily hold the reader's interest in the condition under study. The upper extremity is fully covered and each condition is adequately, but briefly, described with the important steps in the treatment tabulated and followed by typical case reports.

This is an interesting book and will be found valuable to students, general practitioners doing occasional orthopedic work, and orthopedic specialists.

MEDICAL EDUCATION AND THE CHANGING ORDER, by *Raymond B. Allen, M. D., Ph. D.*
142 pages. The Commonwealth Fund, New York, publisher, 1946. Price
\$1.50.

Few people outside of the medical profession realize the fact that the education of a real physician never ceases from his start in medical school until the time he writes his last prescription. This is not so true in the case of the "doctor," pressed with economic problems or personal avariciousness, who cares less for his personal professional development than for other things of a more material nature. Dr. Allen has covered his subject well. He has discussed the many factors and the ideals to be achieved, but so long as we have human nature there will be exploiters and charlatans in the medical field for us all to contend with. Medical knowledge is like the grains of gold recovered by many hours of labor panning many shovelfuls of dirt. There are no short cuts. No person should be allowed to start a specialty until thoroughly grounded in the practice and psychology of medicine. Unless close attention is paid to this problem, the surgeon will rapidly become a mere mechanic, whose technical training has been permitted to supersede his diagnostic acumen. Allen was never more right than when he speaks of medicine as an art. The astute clinician knows when to toss his laboratory reports out of the window in a particular case. One thing that might have been emphasized to greater effect is the responsibility the medical profession has to itself. It is so engrossed in its work, that it is missing the tendency of the tail to wag the dog. Every specialized offshoot of medicine, whatever it may be, owes its beginning to the work of a physician who started it. Medicine needs to take the leadership to cure the conditions in its own house and put it in better order. Since medicine needs the house cleaning suggested by Dr. Allen, it should take the bull by the horns, assume the responsibility and do it. If we don't, someone else will, and we won't like taking the dose prescribed.

PREOPERATIVE AND POSTOPERATIVE TREATMENT, by *Robert L. Mason, Lt. Col., M. C., A. U. S., Cushing General Hospital; and Harold A. Zintel, M. D., Harrison Department of Surgical Research, University of Pennsylvania School of Medicine.* 2d edition. 584 pages, illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1946. Price \$7.

This interesting book of 584 pages, the second edition, is a great improvement over the first volume published in 1937. It is only natural that with the many important advances in surgery during the recent war, a complete revision was necessary to bring this book up to date. This work compiled by a variety of specialists with an increased emphasis on bacteriology, biochemistry, pharmacology, and applied

physiology, includes new chapters on Physical Medicine in Surgical Practice; Pre- and Postoperative care in Gynecology; Pre- and Postoperative care in Surgery of the Stomach and Duodenum; Intestinal Obstruction; Nutrition in Surgery; Vitamin K Therapy; and Emergency Care of Cranial Injuries.

The book is divided into two parts: Part 1, General, includes Preliminary considerations; General Preparation of the Good Risk Patient; Conditions Affecting the Operative Risk; Diagnosis and Treatment of Nutritional Disorders in the Surgical Patient; Surgical Management of Patients with Heart Disease; Hypertension; and Nephritis; Pre- and Postoperative Care of the Diabetic; Anesthesia; Shock; Water Balance; Blood Transfusion; Acidosis and Alkalosis; Ileus; Acute Dilatation of the Stomach; Disruption of the Abdominal Wound; Postoperative Pulmonary Complications of the Urinary Tract; Postoperative Parotitis; Venous Thrombosis; Superficial Burns; and Physical Medicine in Surgical Practice.

Part 2, Regional, covers Pre- and Postoperative Care in Diseases of the Ear, Nose, and Throat; Hyperthyroidism; Acute Empyema and Subphrenic Abscess; Gall Bladder and Biliary Tract; Surgery of the Stomach and Duodenum; Appendicitis; Peritonitis; Obstruction of The Small Intestine, Gynecology, Surgery of Colon and Rectum; Urologic Surgery; and Traumatic Injuries.

As one reads this book, it becomes apparent that there is an enormous amount of material within a moderate number of pages and this leaves one with the feeling that the book is crowded. One reason for this is the excessively long bibliographies following some of the chapters. An example is the excellent short chapter of some 8 pages on Shock, at the end of which 4 pages are utilized for 103 references in small print. However, the subject matter is well arranged, the illustrations are better than average, and the text is up to date, following in many cases the lessons learned in the recent war.

This is an attractively bound book and will be found valuable by medical students, general practitioners and surgical specialists.

THE VENOUS PULSE AND ITS GRAPHIC RECORDINGS: by *Franz M. Groedel, M. D.*
223 pages, 7 illustrations, and 290 tracings. The Brooklyn Medical Press,
New York, 1946. Price \$5.50.

This is the first edition of a monograph devoted to the study of the venous pulse by an author who apparently has exhaustively studied this subject first abroad then in this country. The first 67 pages are devoted to a consideration of the venous pulse. The author presents a comprehensive historical review then a good, inclusive review of the physiology involved. Considerable space is devoted to the technique of obtaining the tracings and the factors which may operate to produce

technical and interpretive errors. Related studies such as the electrocardiogram and heart sound records are considered inasmuch as they are taken simultaneously with the pulse. The next 32 pages deal with the pneumo-cardiogram and the following 5 with the esophago-cardiogram, both physiological studies infrequently heard about in this country. Finally the author presents 83 pages of illustrations of tracings with short summaries of the clinical findings and explanations of the venous pulse tracings.

It seems unlikely that this study will be of much aid to the internist or clinical cardiologist; however, it should be of fundamental importance to those interested in cardio-vascular research.



EMPLOYMENT DURING PNEUMOTHORAX FOR TUBERCULAR PATIENTS

This study deals with the adjustment of pneumothorax patients to work at suitable occupations for tuberculosis patients. We observed 100 patients from the Third Tuberculosis Dispensary.

They were selected by occupation, and not by the previous effectiveness of pneumothorax. Occupations selected were turner, locksmith, mechanic, adjuster, controller, engineer, designer, economist, shop foreman, skilled workman, and accountant. The patients were followed clinically, serial x-rays were done and the result correlated with their jobs. Occupational histories, sanitation and hygiene of working conditions, productivity, and the duration of disability from tuberculosis, were all studied. The working capacity was estimated only after a period of two to three years. Usefulness was measured in terms of the patient's ability to continue work and on the results of the pneumothorax.

The ratio of men to women was 2 to 1. The majority of those observed were between 20 and 40 years of age. Twenty-three of the patients had contact with familial carriers. Eighty percent of all patients showed no bacilli in the sputum. The conditions for which pneumothorax was done in the 100 cases were: infiltrative tuberculosis, 56 cases; chronic disseminated tuberculosis, 17 cases; fibrosis with inflammatory infiltration and tissue destruction, 21 cases; fibrocavernous tuberculosis, 6 cases. Seventy-six completely regained their working capacity, 22 partially, and 2 remained invalids. Of 34 patients who had bilateral artificial pneumothorax, 19 or 55 percent were completely restored; 13, or 38.2 percent partially; while two were permanently disabled.

Skilled workers made up 39 percent of the patients and more than 20 percent were economists. Ninety worked at jobs which were satisfactory from the point of view of sanitation and hygiene: of these 88 continued to work.—VVEDENSKAYA, N. E.: Employment during pneumothorax for tubercular patients. *Am. Rev. Soviet Med.* 3: 216, February 1946.

PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge



TOXIC EFFECTS OF ARSENICAL COMPOUNDS

AS ADMINISTERED IN THE UNITED STATES NAVY
IN 1945, WITH SPECIAL REFERENCE
TO ARSENICAL DERMATITIS

OTTO L. BURTON
Captain (MC) U. S. N.

GEORGE W. JUSTYN
Chief Pharmacist U. S. N.

and

LAURA T. ANDERSON

For the past 21 years medical officers of the Navy have been required to submit to the Bureau of Medicine and Surgery reports of the number of doses of arsenicals administered and the reactions therefrom. Penicillin was added to this report in 1945. This information has been compiled and published in the following issues of this BULLETIN :

September 1925.	October 1934.	October 1938.	October 1942.
January 1927.	January 1935.	January 1939.	January 1943.
January 1929.	October 1935.	October 1939.	November 1943.
July 1930.	January 1936.	January 1940.	January 1944.
October 1931.	October 1936.	October 1940.	October 1944.
October 1932.	January 1937.	January 1941.	January 1945.
April 1933.	October 1937.	October 1941.	October 1945.
October 1933.	January 1938.	January 1942.	January 1946.

In table 1 is shown the number of doses of each arsenical administered in the year 1945, together with the number and type of reactions, and similar data for the 21-year period, 1925 through 1945. It is noted that in 1945 there was 1 untoward reaction to every 2,654 doses and 1 death to every 55,739 doses. For the 21-year period there was 1 reaction to every 2,016 doses and 1 death to every 41,679 doses.

TABLE 1.—*Arsenicals, U. S. Navy, 1945 and 1925-45; type of drug, reaction, and ratio of doses to reactions*

	Number of doses administered	Reactions				Ratio of reactions to doses 1 to —	Ratio of deaths to doses 1 to —
		Mild	Severe	Fatal	Total		
Year 1945:							
Bismarsen.....	(*)	(*)	(*)	(*)	(*)	(*)	(*)
Mapharsen.....	108,922	25	12	1	38	2,866	108,922
Neofarsphenamine.....	2,030	1	2	1	4	507	2,030
Sulfarsphenamine.....	120	0	0	0	0	0	0
Tryparsamide.....	390	0	0	0	0	0	0
Silver arsphenamine.....	16	0	0	0	0	0	0
Total.....	111,478	26	14	2	42	2,654	55,739
21-year period 1925-45:							
Acetarsone ¹	1,013	1	0	0	1	1,013	0
Arsphenamine.....	41,558	27	14	1	42	989	41,558
Bismarsen ²	4,812	0	0	0	0	0	0
Mapharsen ³	1,115,873	129	75	7	211	5,288	159,470
Neofarsphenamine.....	1,394,868	649	334	55	1,038	1,344	25,361
Silver arsphenamine ⁴	607	0	1	1	2	303	607
Sulfarsphenamine.....	31,109	17	8	0	25	1,244	0
Tryparsamide.....	77,632	3	1	0	4	19,408	0
Total.....	2,667,472	826	433	64	1,323	2,016	41,679

* Figures not given, as many activities reported bismuth as bismarsen.

¹ First administered during the year 1932.

² First administered during the year 1929.

³ First administered during the year 1935.

⁴ First administered during the year 1931.

A total of 7,441 courses of penicillin (2,400,000 units each) were administered in the treatment of syphilis during the year 1945.

TABLE 2.—*Proportion of reactions of various types, 1929-45*

Classification	Number of reactions	Percent of total reactions
Arsenical dermatitis.....	416	38.30
Vasomotor phenomena.....	371	34.16
Liver damage.....	66	6.08
Reactions of minor importance.....	61	5.62
Blood dyscrasias.....	48	4.42
Jarisch-Herxheimer reaction.....	30	2.76
Table reaction.....	26	2.39
Gastro-intestinal disturbance.....	24	2.21
Arsenical hypersensitivity.....	12	1.11
Hemorrhagic encephalitis.....	11	1.01
Acute renal damage.....	4	.37
Arsenical neuritis.....	4	.37
Optic neuritis.....	3	.28
Liver damage (doubtful reaction).....	3	.28
Toxic encephalopathy.....	2	.18
Vascular damage (probable adrenal hemorrhage).....	1	.09
Borderline hemorrhagic encephalitis.....	1	.09
Fever.....	1	.09
Circulatory collapse.....	1	.09
Polyneuritis.....	1	.09
Total.....	1,086	100.00

ARSENICAL DERMATITIS

Dermatitis in some form was included in 11 or 26 percent of the total reactions in 1945, as compared to 32 percent for 1944. The type of lesion was exfoliative in 4 instances, erythematous in 2, maculo-petechial in 1, maculo-papular in 1, macular in 1, papular in 1, and 1 was not classified. The reactions were classified as 5 mild and 6 severe.

Mild Reactions

The 5 mild reactions occurred after the following number of injections: Two after the fifth, and one each after the sixth, thirteenth, and eighteenth. The interval between the injection and appearance of symptoms ranged from 6 hours to 14 days. The length of time required for complete recovery varied from 2 to 13 days, although in one case a hyperemia persisted for more than two weeks after discharge.

MAPHARSEN

Case 1.—The history of exposure to infection in this case is unknown. On 17 April 1945, patient was found to have a penile lesion which was positive for *Treponema pallidum*. He was transferred to a naval hospital where the diagnosis of syphilis was confirmed. A Kahn blood test on 23 April was 1-plus. The patient was given 2,400,000 units of penicillin and started on a 26-week course of mixed therapy, receiving the following treatment before discharge: 0.03 gram of mapharsen on 27 April, 0.04 gram on 30 April, and 0.2 gram of bismuth on 25 April. After discharge from the hospital he received 0.06-gram injections of mapharsen on 3, 7, and 11 May. Several hours after the last injection the patient felt feverish and developed arthralgias and an eruption which was not observed. On 15 May, a 0.04-gram injection of mapharsen was given simultaneously with a subcutaneous dose of 4 minims of adrenalin. Five hours later his temperature rose to 103.4° F. and he complained of arthralgias. An urticaria of the right buttock and a maculo-petechial eruption about the ankles was observed 24 hours later. The patient made an uneventful recovery. The patient stated that he had had similar lesions following previous injections but these apparently had not been observed. In view of the foregoing and upon advice of the hospital dermatologist, further chemotherapy was discontinued. Recovery time was not reported.

Case 2.—This patient was exposed to infection on 7 July 1944 and on 1 August the initial lesion appeared on anterior left of midline on shaft of penis. Dark-field examination on 11 August was positive for *Treponema pallidum*, and a Kahn blood test on the same day was 2-plus. Treatment with mapharsen was instituted and 10 injections, a total of 0.57 gram, were given between 11 August and 9 October. Eleven injections of bismuth subsalicylate, a total of 1.43 grams, were given between 9 October and 18 December 1944. The reactions occurred about 6 hours after the eighth, ninth and tenth mapharsen injections. The patient developed a mild, itching maculo-papular rash, but no temperature. No reaction occurred during the bismuth treatment, but following three 0.06-gram mapharsen injections, given on 26 and 29 December 1944, and 4 January 1945, the skin reactions recurred in increasing severity. Treatment for the reactions consisted of local applications of calamine lotion. No laboratory work was completed.

Recovery was complete 13 days after the last reaction.

Case 3.—Following exposure to infection on 11 March 1945, this patient developed a sore on the penis, darkfield examinations of which were positive for *Treponema pallidum* on 28 April. A 26-week antiluetic regime was begun on 19 May. Eighteen 0.06-gram mapharsen injections and five 0.5-gram bismuth subsalicylate injections were given between 29 April and 26 June 1945. The patient complained of generalized pruritus and dermatitis of lower legs and palms when he reported for his nineteenth injection and stated that these symptoms had occurred 3 days after the previous mapharsen injection. White blood count and

differential were within normal limits and urinalysis was negative. No treatment was given for the reaction, but penicillin therapy was instituted in order to avert the possibility of an exfoliative dermatitis.

Recovery 10 days after discontinuance of mapharsen.

Case 4.—This patient was exposed to infection on 15 May 1945, and four days later developed a sore on the shaft of penis. *Treponema pallidum* was demonstrated by darkfield examination on 23 May. Treatment consisted of 0.06-gram mapharsen injections on 23, 25, 28, 30 May and 1 June and a 0.13-gram injection of bismuth subsalicylate on 30 May. The time elapsing between the injection and appearance of initial symptoms was not reported. Examination on 1 June revealed an erythematous dermatitis on face, chest, and upper arms. Laboratory findings: White blood count 7,600 with 81 segmented cells, 10 lymphocytes, and 3 basophiles.

Treatment consisted of bed rest and patient recovered in 2 days.

NEOARSPHENAMINE

Case 5.—This patient was treated for a Vincent's infection of the gingivae. Neoarsphenamine injections were given spaced 3 days apart, as follows: First injection, 0.3 gram, second injection, 0.6 gram, and third, fourth, and fifth injections, 0.9 gram each. The reaction started during the series and within 14 days after the initial dose. Clinical manifestations: Temperature 101° F., flushed face, and a large macular rash over the entire body, except the face, palms of hands, and soles of feet.

Arsenic therapy was discontinued. Forced fluids and sodium thiosulfate, intravenously and orally, were prescribed. The patient was discharged from the sick list on 23 January, 5 days after admission, although a hyperemia still persisted and the skin did not assume its normal appearance for more than 2 weeks.

Severe Reactions

The six severe reactions occurred after the following number of injections: One each after the second, tenth, twenty-fourth, thirty-fourth, thirty-fifth and fifty-first. The interval between the injection and the appearance of symptoms varied from 2 to 6 days. The length of time required for recovery varied from 7 to 44 days. The recovery time was not reported in 4 cases.

MAPHARSEN

Case 6.—This patient developed a primary sore on shaft of penis on 24 April 1945, four weeks after exposure to infection. A darkfield examination on 27 April was positive for *Treponema pallidum*. Twenty 0.06-gram injections of mapharsen and six 0.2-gram injections of bismuth were given between 27 May and 1 August. A second course of arsenical treatment was begun with a 0.06-gram injection of mapharsen on 12 September, followed by 0.06-gram injections on 15, 18, and 21 September. Following the second injection the patient noticed an exfoliative dermatitis on his hands and feet. Mapharsen was discontinued on 21 September. He was admitted to the sick list on 6 October, with a diagnosis of poisoning, therapeutic, acute, mapharsen, syphilis, hands, arms, and legs. Physical examination revealed a dermatitis of hands, arms, feet, and legs. No treatment or laboratory work was done and the patient was transferred to a naval hospital on 6 October. Recovery time and treatment were not reported. In the medical officer's opinion this was a cumulative reaction.

Case 7.—This patient was exposed to infection in January 1945 and developed a typical indurated chancre and inguinal lymphadenopathy. A darkfield examination was positive on 13 January. Dates were not available for the first 17 mapharsen injections, a total of 8.3 grams, and the 9 bismuth injections, a total of 1.8 grams. Mapharsen was continued with a 0.012-gram injection on 17 June, a 0.02-gram injection on 19 June, a 0.03-gram injection on 21 June, a 0.045-gram injection on 24 June, and thirteen 0.06-gram injections from 26 June to 8 August 1945. Nine 0.2-gram injections of bismuth were given from 11 June to 27 August. Two days after the last mapharsen injection, a generalized, dry, scaly skin eruption with thickening, induration and erythema of the skin appeared. Some fissures of the skin were present in the cubital fossa and behind the ears. Excoriations about the face, ears, neck, and arms had a tendency to ooze serum. The dermatitis could be described as a moderately severe eczematous type, almost bordering on a chronic exfoliative dermatitis. There was slight enlargement of the inguinal lymph nodes and moderate enlargement of the axillary and cervical nodes.

Laboratory findings: Urinalysis—normal; red blood count, 5,000,000; hemoglobin, 102 percent; white blood count, 8,300, with 56 percent segmented cells, 19 percent eosinophiles, and 25 percent lymphocytes. All Kahn blood tests were negative. The finding of the spinal fluid examination on 9 April was not recorded in the health record.

Heavy metals were discontinued. No BAL in oil being available, a course of 2,700,000 units of penicillin was started on 1 September and completed on 10 September. No reactions were recorded from the penicillin injections. Under treatment with zinc oxide ointment the skin improved steadily except for some thickening. On 25 September the patient was allowed up and about and sweating caused a flare-up of the skin eruption on the arms, face, and neck. On 1 October his diagnosis was changed from dermatitis, acute to poisoning, therapeutic, arsenical, syphilis. Improvement in the skin condition followed treatment with a lotion of lime water and oil and only a few excoriated, weeping lesions remained on 14 October. The patient was transferred to a naval hospital and recovery time was not reported.

Case 8.—After exposure to infection in May 1944, a diagnosis of syphilis was made on 19 July 1944 by a 4-plus Kahn blood test. Treatment with mapharsen started with a 0.03-gram injection on 20 July followed by thirty-four 0.06-gram injections from 25 July 1944 to 6 January 1945. Bismuth, given concurrently in 1-cc. injections, amounted to 14 cc. The reaction occurred approximately 48 hours after the last mapharsen injection. The patient was admitted to the sick list on 10 January 1945, because of a generalized, erythematous, papular eruption with areas of vesiculation and crusting involving the ankles, scalp, and hands. On 17 January, when he was transferred to a hospital activity, the lesions had spread to involve the entire body, except the palms and soles. The vesiculo-papular eruptions on the lower arms had become secondarily infected with large superficial pustules and concomitant edema. There was moderate generalized adenopathy. By 9 February the lesions had resolved to a dry scaling eruption involving the hands, fingers, forearms, scalp, and ears with vesicular lesions remaining on both legs and ankles.

Treatment for reaction: 10 January to 17 January—Compound calamine lotion; half-strength Whitfield's ointment; starch baths; moist sodium hyposulfate compresses; and ointment and lotions.

17 January to 9 February—Continuous saline compresses; vaselin; and starch compresses.

9 February to 23 February—Routine soothing lotions and boric acid packs:

and U. S. P. calamine lotion with 1-percent phenol and $\frac{1}{4}$ of 1-percent resorcin. Bismuth in 1 cc. injections was continued weekly.

Laboratory findings: 17 January—White blood count, 12,800; polymorphonuclears, 74 percent; and lymphocytes, 26 percent.

18 January—Blood Kahn, negative; red blood count, 4.26; white blood count, 10,400, hemoglobin, 14 grams; urine, trace of albumin; white blood cells 15 to 18 per high dry field, otherwise negative.

12 February —Blood Kahn, negative; routine blood and urine examinations, negative.

Discharged to duty 23 February. Recovery in 44 days.

Case 9.—This patient was admitted to the sick list with a diagnosis of syphilis on 18 November 1943. The syphilis existed prior to his entry into the naval service and antileptic therapy had been received while in civilian life. Treatment in the service given between 19 November 1943 and 25 January 1945 consisted of 51 mapharsen injections, a total of 3.12 grams, and 24 bismuth injections, a total of 5.14 grams. The last four mapharsen injections had been given on 4, 11, 18, and 25 January 1945. The patient stated that a body rash first appeared on 17 January. He was transferred to a hospital on 6 February and treated with 1.5-cc. injections of BAL at 1530, 1930, and 2030 on 6 February; at 0330 and 0800 on 7 February; and at 0800 on 8, 9, 10, 11, and 12 February. Laboratory examinations: Urine contained rare hyaline and red blood cells on 6 February, and rare red blood cells on 11 February. The itching subsided after the first BAL injection and the rash had lessened after the seventh BAL injection on 9 February. On 11 February the rash had disappeared except for some exfoliation and peeling on the hands where there had been open lesions.

Case 10.—On 13 January 1945 this patient (a supernumerary) was examined and found to be three-months pregnant. A blood specimen submitted for routine Kahn test was positive on 9 February. Biweekly injections of arsenicals were started, 0.06-gram mapharsen injections being given on 9 and 13 February. The supply of mapharsen was depleted and treatment was continued with neoarsphenamine, three 0.6-gram and five 0.4-gram injections being given between 16 February and 20 March. The patient reported for routine treatment on 23 March and it was observed that she had developed a diffuse exfoliative dermatitis. All antileptic treatment was discontinued and the patient examined at periodic intervals. On 4 April the patient failed to appear for examination, and the ambulance was dispatched to bring her to the clinic. On arrival she was examined and the skin lesions found to be secondarily infected. The patient was hospitalized with a diagnosis of poisoning, therapeutic, acute (neoarsphenamine).

Recovery time and treatment were not reported.

Case 11.—This patient had been hospitalized for some time because of a resistive chronic nonspecific prostatitis. All efforts to clear up this infection had been of no avail and it was decided to treat him with neoarsphenamine. A 0.3-gram injection was given on 27 April and on 7 May 1945. Following the second injection the patient developed a temperature, pain in the stomach, and a body rash. The rash increased in severity and the patient developed a severe sore throat. Physical findings on 11 May showed a markedly red throat and a generalized florid, macular, erythematous rash with an intense scarlatiniform rash over the neck and chest. Blood Kahn was negative.

Treatment instituted with 10-percent BAL, and 1.75-cc. injections were given at 1500, 1900, and 2000 on 11 May; at 0300, 0700, 1100 and 1500 on 12 May; and at 1500 on 13 and 14 May. The rash started to fade after the first BAL injection and had completely cleared by 12 May. Recovery complete in 7 days.

COMMENT

In 1945, medical officers of the Navy administered a total of 111,478 doses of arsenicals, 7,441 courses of penicillin, and reported the occurrence of 42 untoward reactions. Of these toxic reactions, 11 were cases of arsenical dermatitis, a ratio of one to every 10,134 doses. Of interest in connection with a review of the causes of arsenical dermatitis are the instances in which premonitory signs were noted. They tend to indicate the necessity for careful examination and questioning of each patient before administering an arsenical.

For example, in case 1, the patient developed a temperature and arthralgias and an eruption which were not observed. A maculopetechial eruption occurred 24 hours after the administration of a 0.04-gram injection of mapharsen and 4 minims of adrenalin. The patient stated that similar lesions had occurred in a hospital, but these had not been observed. In case 2, the patient developed a maculopapular rash following the eighth, ninth, and tenth mapharsen injections and the rash increased in severity following three additional mapharsen injections. In case 6, the patient developed an exfoliative dermatitis following the twenty-second mapharsen injection and two additional injections were given before the patient was hospitalized with the diagnosis of poisoning, mapharsen, therapeutic, acute.



PRELIMINARY REPORT ON THE EVALUATION OF PENICILLIN IN THE
TREATMENT OF YAWS

Author's summary.—In summary it may be said that penicillin holds definite promise as a therapeutic agent in yaws. Its use in doses of 1,200,000 O. U. in adults and proportionate doses for children given over periods of four, two, and one days, respectively, resulted in rapid clinical cures. The serologic response was not as striking as the clinical, but until more follow-up figures are obtained a full evaluation is not possible. The oil-beeswax preparation of penicillin made it possible to treat patients on an ambulatory basis over one and two days with the same dose of penicillin given in aqueous solution to hospitalized patients over four days. The immediate clinical and serologic results obtained with penicillin in oil with beeswax appeared to be as good as those of the aqueous solution. The development of a successful one-day treatment schedule would be of great practical value in a country such as Haiti where large numbers of patients must be treated on an ambulatory basis in rural clinics. A report on 12 months follow-up observations will be made at a later date.—DWINDELLE, J. H., REIN, C. R., STERNBERG, T. H., and SHELDON, A. J.: Preliminary report on the evaluation of penicillin in the treatment of yaws. *The American Journal of Tropical Medicine* 26: 311-318, May 1946.

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- Griffith, Phillip M.**, Ensign, H (S) USNR (*Tstutsugamushi Disease on Samar, Philippine Islands*, p. 1669). B. A. Montana State University, 1941.
- Gunther, Lewis**, Commander (MC) USNR (*A Clinical Note on the Use of Desoxycorticosterone Acetate in the Treatment of Duodenal Ulcer*, p. 1743). Junior Certificate, University of California at Los Angeles, 1921; M. D., Yale University School of Medicine, 1926. Intern, Los Angeles County Hospital, 1926; assistant resident in medicine, 1927, and assistant in medicine, 1928-29. University of California Medical School; attending physician, Los Angeles County Hospital, 1929-37; associate senior physician, Cedars of Lebanon Hospital, Los Angeles, 1942; consulting supervisor, Cedars of Lebanon Medical Clinic; co-chief, cardiology, Mount Sinai Hospital, Los Angeles; consulting physician, University of California at Los Angeles; attending physician, Santa Monica Hospital and St. John's Hospital, Santa Monica, Calif., 1942; assistant clinical professor of medicine, College of Medical Evangelists, 1939-. Fellow American Medical Association; member American Heart Association. Diplomate American Board of Internal Medicine.
- Gunther, Walter A.**, Lieutenant Commander (MC) USNR (*An Apparatus for the Reduction of Fractures of the Wrist and Forearm*, p. 1760). B. S., Manhattan College, 1931; M. D., Albany Medical College, 1936. Intern, Troy Hospital, Troy, N. Y., July-Nov. 1936; Arnot-Ogden Memorial Hospital, Elmira, N. Y., July 1937-July 1938; assistant in orthopedics, Samaritan Hospital, Troy, N. Y., 1938-43; resident in orthopedic surgery, Knoxville General Hospital, Knoxville, Tenn., July 1946-. Member Medical Society of the State of New York.
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- Mills, Robert L.**, Lieutenant, junior grade (MC) USNR (*Treatment of Uremia with Continuous Peritoneal Irrigation*, p. 1745). A. B., Stanford University, 1941; M. D., Stanford University School of Medicine, 1944. Intern in surgery, Jan. 1944–Sept. 1944, junior resident in surgery, Oct. 1944–April 1946. Stanford University Hospitals, San Francisco, Calif.
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- O'Neill, James N.**, Commander (MC) USNR (*Diagnosis and Surgical Management of Thoracoabdominal Wounds Aboard an Assault Transport*, p. 1724). B. S., St. Louis University, 1926; M. D., Rush Medical College, 1928. Fellow in comparative anatomy, Marquette University, 1921–23; clinical clerk, Presbyterian Hospital, Chicago, Ill., 1927; intern, St. Mary's Hospital, Milwaukee, Wis., 1928; resident, Milwaukee County Institutions, 1929; resident house surgeon, Cook County Hospital, Chicago, 1930–32; postgraduate study in surgery and pathology, University of Vienna, 1932–33; private practice, surgery, Los Angeles, Calif., 1934–42; instructor in surgery, University of Southern California, 1934–; junior attending surgeon, Los Angeles County Hospital, Los Angeles, 1935–; executive staff, Queen of Angels Hospital, 1934–; staff: Methodist Hospital of Southern California, French Hospital, and Cedars of Lebanon Hospital, Los Angeles, 1934–; Presbyterian Hospital–Olmstead Memorial, Hollywood. Fellow: American Medical Association, and American College of Surgeons, member: Los Angeles County Medical Association, California Medical Association, Southern California Medical Association, Hollywood Academy of Medicine, and Los Angeles Surgical Society. Diplomate American Board of Surgery.
- Pearlman, Reuben C.**, Lieutenant Commander (MC) USNR (*The Use of Tantalum in Tendon Reconstruction of the Hand*, p. 1647). B. S., University of Kentucky, 1917; M. D., Johns Hopkins University School of Medicine, 1923. Intern, South Side Hospital, Pittsburgh, Pa., 1923–24, Columbia Hospital for Women and Lying-In Asylum, Washington, D. C., 1924–25, Mount Sinai Hospital, New York City, N. Y., 1925–26; postgraduate study, plastic surgery, Europe, 1926–27; private practice, Louisville, Ky., 1927–42; owner of The R. C. Pearlman Plastic Surgery Hospital and Clinic, Louisville, Ky. Member: American Medical Association, Johns Hopkins Surgical Society, Kentucky State Medical Association, and Jefferson County Medical Society.
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Weiss, Jacob A., Commander (MC) USNR (*Penicillin Prophylaxis Against Acute Otitis Media in Scarlet Fever*, p. 1711). B. S., University of Chicago, 1922; M. D., Rush Medical College, 1924. Intern, 1924-26, and associate attending physician, 1933-, Michael Reese Hospital, Chicago, Ill.; attending physician, Illinois Eye and Ear Infirmary, Chicago, 1946; consultant, Winfield Sanatorium, Winfield, Ill., 1936-; faculty of University of Illinois College of Medicine, 1946. Fellow: American Medical Association and American Academy of Ophthalmology and Otolaryngology; member Chicago Otolological and Laryngological Society; Chicago Medical Society. Diplomate American Board of Otolaryngology.

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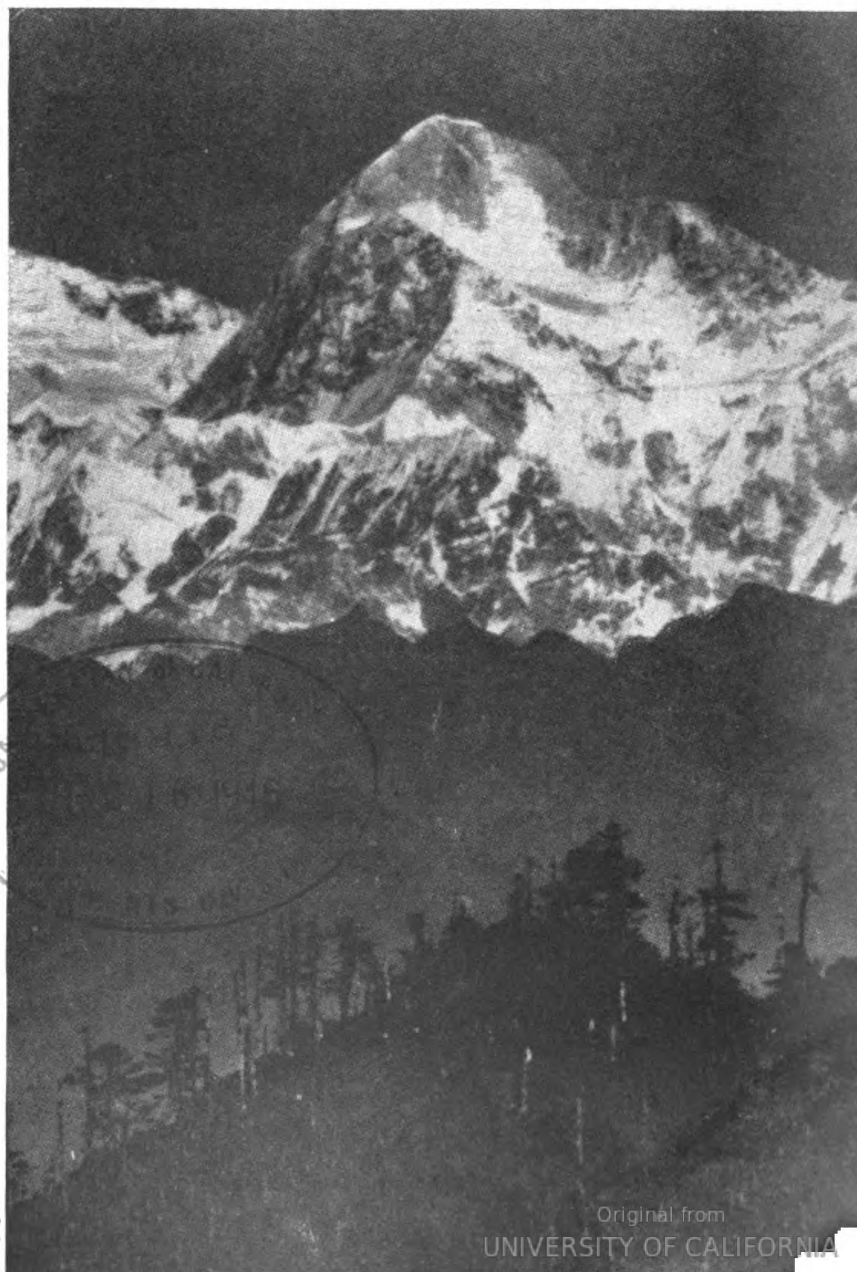


DECEMBER 1946

**BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.**

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COVER PHOTOGRAPH

The cover picture shows the rugged slopes of Mount Everest, up which many scientific expeditions have climbed. In the leading article in this number of the BULLETIN, 'Operation Everest,' are described the changing physiological effects of the ascent as duplicated in the pressure chamber of the School of Aviation Medicine at Pensacola.

—Official U. S. Army A. F. photo

In 1947 the UNITED STATES NAVAL MEDICAL BULLETIN will be published bi-monthly instead of monthly. This is necessary because of the reduction in appropriations for printing and binding.

The next issue will be the January-February number, the publication date of which will be about 20 January 1947. Succeeding numbers in 1947 will be those for March-April, May-June, July-August, September-October, and November-December. Delivery will be made about the 20th of the first month named in each of these issues.

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**THE MISSION OF THE MEDICAL DEPARTMENT OF THE NAVY
TO KEEP AS MANY MEN AT AS MANY GUNS
AS MANY DAYS AS POSSIBLE**



MONTHLY

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NAVY DEPARTMENT,
Washington, March 20, 1907.

THIS UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated :

All numbers up to and including 1921.

Volume 16, 1922, Nos. 4 and 5.

Volume 17, 1922, Nos. 4 and 6.

Volume 18, 1923, Nos. 1, 2, 3, and 5.

Volume 19, 1923, Nos. 2 and 3.

Volume 20, 1924, Nos. 2, 5, and 6.

Volume 24, 1926, Nos. 1, 2, and 4.

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PREFACE



THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying Medical Department personnel of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

With the establishment of the Nurse Corps in 1908 and the Dental Corps in 1912, the function of the BULLETIN was broadened to serve in a similar capacity for members of those Corps.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine and dentistry, editorial comment on current literature of special professional interest to Medical Department personnel, clinical notes on interesting cases, descriptions of suggested devices, reports from various sources, notes and comments on topics of professional interest, and notices of newly published professional books.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T McINTIRE,
Surgeon General, United States Navy.

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It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

LOUIS H. RODDIS, *Editor,*
Captain, Medical Corps,
United States Navy.

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SPECIAL ARTICLES



OPERATION EVEREST¹

A Study of Acclimatization to Anoxia²

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If man is suddenly exposed to severe oxygen lack, such as may occur at high altitudes, in asphyxia, or in numerous types of disease or injury of the pulmonary system, symptoms appear rapidly. Impairment of cerebral function, muscular incoordination, cardiovascular changes, and loss of consciousness are the most prominent of these. If, however, the oxygen deprivation develops gradually over a period of weeks or months, certain physiological changes, known as acclimatization, protect the organism from anoxia. The effectiveness of acclimatization is most dramatically demonstrated by the mountaineer who can live and work as high as 28,000 feet, an altitude which produces unconsciousness in less than 5 minutes in unacclimatized man. Clinical conditions in which anoxia may develop slowly enough to give rise to acclimatization are represented by chronic pulmonary fibrosis, emphysema, and cardiac decompensation. It may be seen that adaptation to anoxia is important to mountaineers and also clinically, and furthermore that some of the functional changes involved may be of service to the aviator.

¹ This research project was a team effort in every sense of the word. It would not have been possible without the efforts of Captain Louis Iverson (MC), U. S. N., Captain Ashton Graybiel (MC), U. S. N. R., Lt. Comdr. Richard L. Riley (MC), U. S. N. R., Lt. Comdr. Margaret L. Haley (NC), U. S. N., Lt. Walter H. Jarvis, Jr. (MC), U. S. N., and Lt. John L. Patterson, Jr. (MC), U. S. N. R., and the invaluable technical assistance of Mr. Frank Consolazio and Mr. George Selden.

² The illustrations in this article are intended to give the general background under which the study was conducted but are not necessarily directly connected with it.

Operation Everest (a Bureau of Medicine and Surgery Research Project) was a detailed study of those changes which take place in circulatory and respiratory physiology during slowly increasing oxygen lack. Numerous expeditions have made similar studies in the Alps (1), the Andes (2), and the American Rockies (3). Mountain expeditions, however, are handicapped in their accomplishments by difficult terrain, adverse climatic and living conditions, and inadequate laboratory facilities. Even more important is the fact that in such studies, the observers themselves are affected by the altitude, and their observations thus are frequently colored by the very effects they are studying. Consequently, the low pressure chamber offers an exceptional opportunity to study men under comfortable, controlled environmental conditions, with complete technical facilities at hand, under circumstances such that the observers are totally unaffected by anoxia.

The preparations for Operation Everest occupied more than 3 months. It was essential to install complete auxiliary vacuum pumps, electrical generators, lighting and communication systems, so that failure of the standard equipment would not cause the termination of the study. It was necessary to equip the largest available low-pressure chamber with all possible conveniences and comforts, and to provide a well-stocked and staffed galley where controlled and appetizing diets could be prepared. Since a 24-hour watch would be required to operate the chamber and to safeguard the subjects, a large and well-trained crew was needed. And most important of all, several teams of research workers, well coordinated and supplied with all laboratory facilities, would be required. Volunteer subjects were selected who were in the best possible physical and psychological condition, and these were instilled with the motivation necessary to survive the boredom of a month in close quarters, the discomforts of high altitude, and the unpleasant features of the various tests. The study was the product of teamwork and cooperation, involving some 40 men and women, each of whom contributed to the final accomplishments. Though all cannot be listed here, no report would be complete without an acknowledgment of the efforts of the entire group, and particularly of the cooperation and patience of the four volunteers.

The large rectangular chamber measuring roughly 10 by 10 by 7 feet, inside dimensions, was stripped of extraneous gear and fitted with double decker bunks, a table, chairs, toilet and other facilities. By use of the communicating lock observers wearing oxygen masks could enter the chamber for tests or housekeeping details. The chamber was continuously ventilated, and repeated measurements of the oxygen content of the chamber air by means of a Pauling meter, checked daily by comparison with Haldane gas analysis, demonstrated that no significant amount of oxygen accumulated even when several

observers were using oxygen within the chamber. Chamber temperature was held between 65° and 80° F. as the subjects desired.

Ascent was made at the rate of 2,000 feet per day to 9,000 feet, at 1,000 feet per day to 15,000 feet, and at 500 feet per day thereafter. Usually the ascent was made gradually during a 2-hour period in the evening.

Before the subjects arose at 0615 the resting pulse, blood pressure, and a sample of alveolar air were obtained; the subjects were then weighed. Breakfast followed immediately, and an hour later the arterial-alveolar studies were performed as follows: An indwelling needle was placed in the brachial artery, and the subject was allowed to breathe through appropriate valves so that inspired respiratory volume could be measured and expired air collected. Samples of arterial blood and expired air were then collected simultaneously during a 1-minute period after the subject had become nearly basal. Following a rest period similar samples were obtained between the seventh and eighth minutes of standardized work on a bicycle ergometer. On these resting and working bloods the following determinations were made: Carbon dioxide and oxygen tensions, oxygen content, oxygen capacity, and oxyhemoglobin saturation, pH, carbon dioxide content, hematocrit, whole blood and serum specific gravity, blood sugar, and lactic acid. Percentages of oxygen and carbon dioxide were determined in the expired air and from these the oxygen consumption, carbon dioxide output, and respiratory quotient were calculated. Later in the morning a period of recreation and exercise was scheduled during which the men rode the bicycle and worked on various handicrafts.

Following the noon meal the subjects rested for an hour, after which resting electrocardiograms were taken with four standard leads. A 20-inch step test of physical fitness was then given as follows: Each of the subjects stepped up and down at the rate of 30 times per minute for 30 seconds on one day, at the same rate for 2 minutes on the second day, and on the third day they continued at this rate for as long as possible—the capacity test. By means of 2 sternal, 1 apical, and 3 limb electrodes cemented to the skin, not only the seated resting record, but also the record during work and during an 8-minute recovery period was taken. After the capacity test, standard electrocardiograms were made using the precordial and the 3 limb leads. The late afternoon and evening were spent in bathing, supper, and in watching movies shown inside the chamber.

At periodic intervals a portable x-ray machine was taken up in the lock and 6-foot films of heart size were made on the subjects. Every third day complete blood counts were done, and urinalyses were performed at frequent intervals.



—Official U. S. Navy Photo.

FIGURE 1.—Front view of main building, Medical Department, U. S. Naval Air Training Bases, U. S. Naval Air Station, Pensacola, Florida. The School of Aviation Medicine and the pressure chamber used for the "Operation Everest" are among the activities located in it.

The clinical condition of the subjects was appraised in several ways. Observers were continuously on watch at a post for 24 hours a day to note every sign and symptom, and all the casual remarks and unstudied actions of the subjects. Each evening the subjects filled out detailed questionnaire sheets dealing with symptoms, and one observer visited the subjects for an hour every day to form an objective impression of their degree of acclimatization. Diets were not restricted, but intake of proteins, fats, carbohydrates, total calories, ascorbic acid, thiamine, niacin, and riboflavin were measured on each man each day. On the last 3 days of the study altitude tolerance was evaluated by an 8-hour ascent to 29,000 feet without supplementary oxygen, and a 5-hour ascent to 50,000 feet using only the non-pressurized diluter demand oxygen regulator. On the final day physical fitness tests were run both with and without supplementary oxygen. Descent to sea level was made over a 2-hour period, and the subjects were held under observation for 3 days at sea level while tests similar to those made at altitude were run.

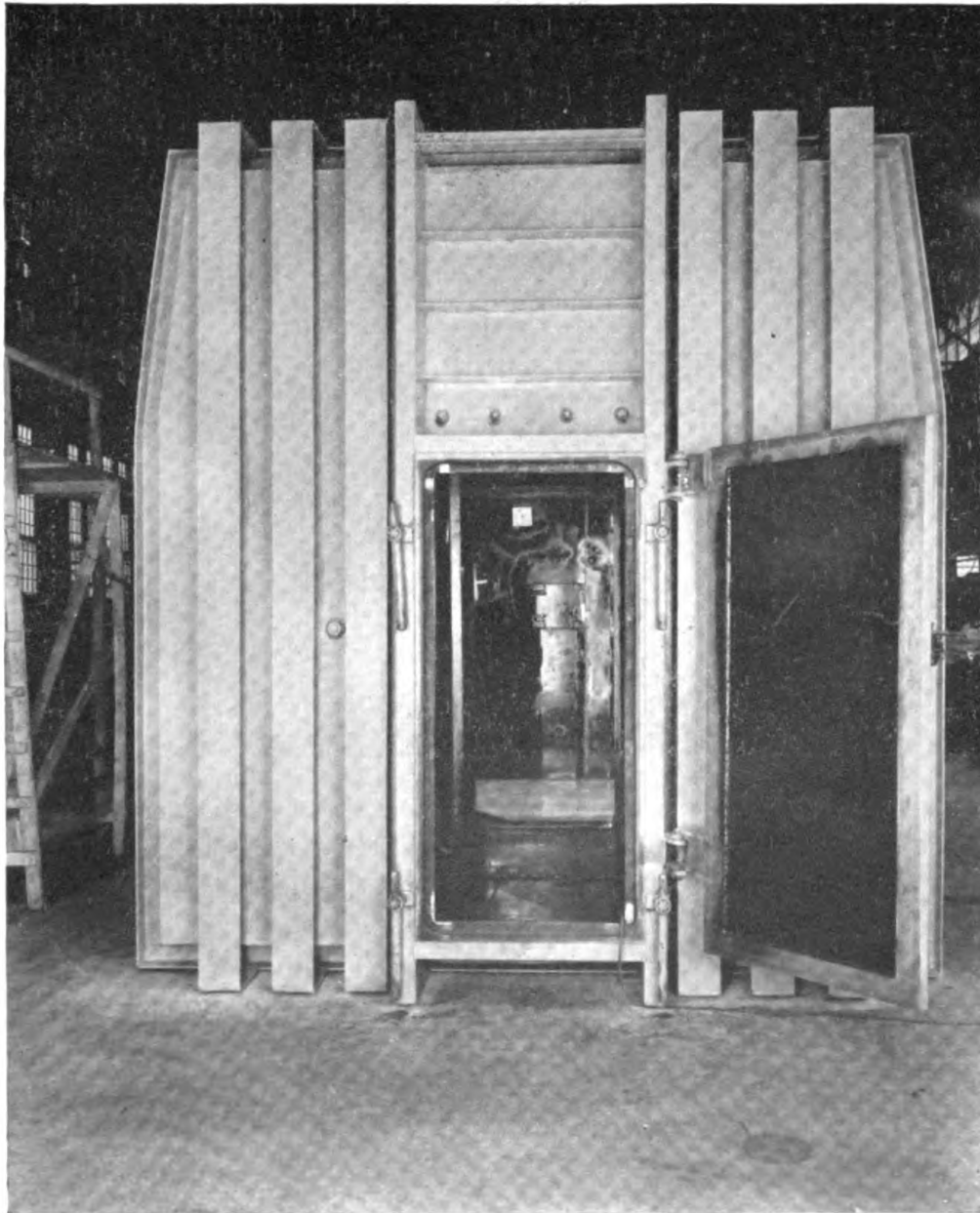
RESULTS

Detailed analysis of the mass of data accumulated will appear in various individual reports and only a broad survey is reported here.

None of the subjects was seriously affected by altitude below 20,000 feet, and at no time during the study was the clinical picture of "moun-

tain sickness" observed. There was a general tendency to laziness and loss of strength; the subjects did not wish, and in fact were unable to exercise as much above 18,000 feet as below.

Due in part to the Cheyne-Stokes type of breathing which appeared as low as 13,000 feet, the subjects' sleep was broken, but all appeared and felt rested in the morning. All four noted a gradual decline in appetite, reflected not only in reduced caloric intake, but also in an average weight loss of 6 pounds during the last 2 weeks of the study. Cyanosis was marked and increased during work. Dyspnea on exer-

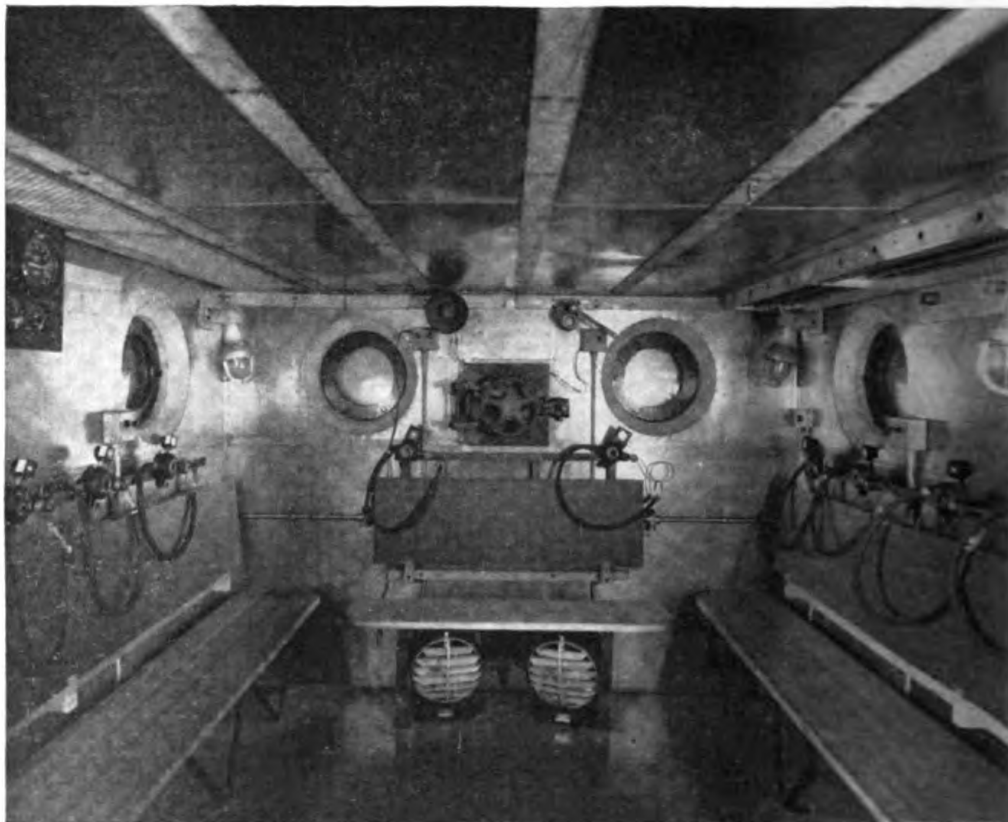


—Official U. S. Navy Photo.

FIGURE 2.—Exterior view and entrance to a pressure chamber, School of Aviation Medicine, U. S. Naval Air Training Bases, Pensacola, Florida.

tion was the chief complaint, first appearing at about 10,000 feet, and increasing to become a major factor which, together with weakness, limited the performance of work.

The changes in blood and alveolar gases may be summarized as follows: Arterial carbon dioxide pressure fell progressively to levels as low as 17 mm. at rest with corresponding oxygen pressure of 29 mm. Several resting arterial oxygen saturations below 60 percent were found, and in most cases both the arterial oxygen pressure and satura-



—Official U. S. Navy Photo.

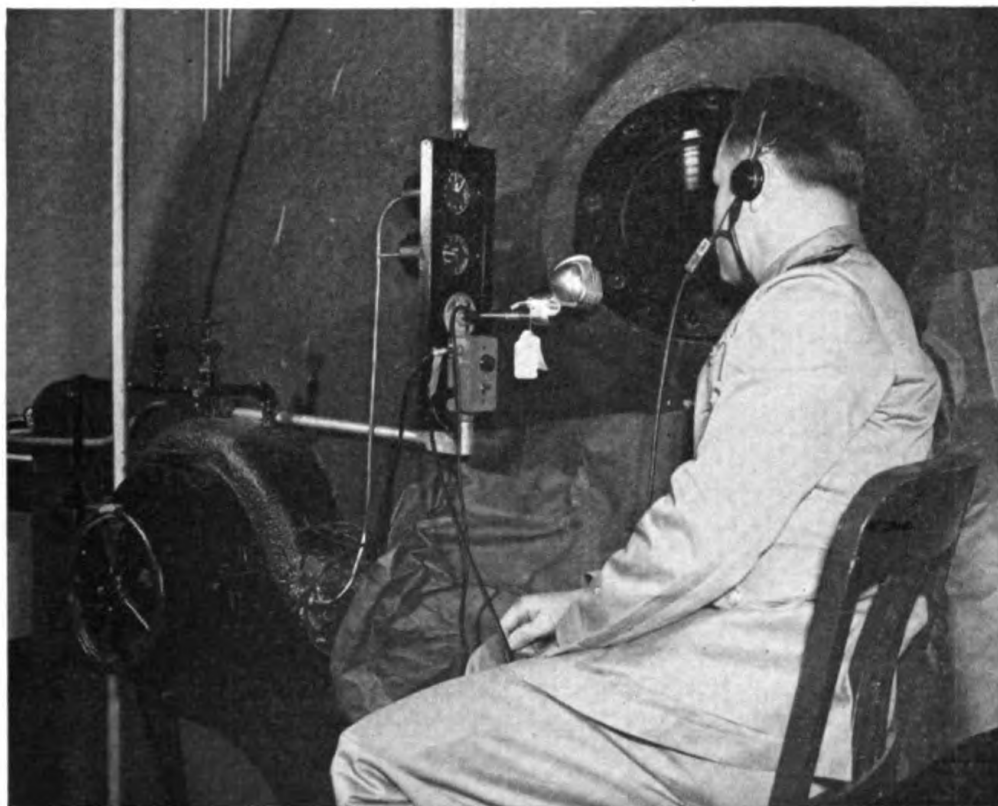
FIGURE 3.—Interior view of a pressure chamber, School of Aviation Medicine, U. S. Naval Air Training Bases, Pensacola, Florida.

tion fell during work. Above 10,000 feet alkaline reserve decreased from a sea level average of 46 vols. % to an average of 34 vols. %. All four men became alkalotic with arterial pH values of 7.45 to 7.60; despite this and the low carbon dioxide pressures no signs of tetany were seen. Although the alveolar *oxygen* pressures followed the mean curve described by Boothby (4) the alveolar *carbon dioxide* pressures fell below the Boothby curve by 5 mm. at 18,000 feet and 10 mm. at 25,000 feet.

The reticulocyte count, as well as the hemoglobin content and red cell count increased moderately in all four subjects. The polycythemia, however, was not great (no counts exceeded 6.7 million) and bore no constant relation to the completeness of acclimatization. Cer-

tain findings pointed to the development of an inactive type of hemoglobin, but further work is required to determine the significance of this observation.

Comparative analysis of the resting electrocardiograms indicates that several changes occurred. Most subjects developed progressive lowering of the T-wave with increasing altitude up to 16,000 feet, but the trend was reversed above this altitude and records taken at the peak altitudes show T-waves actually higher than at sea level in some instances. Premature beats, slight prolongation of the P-R interval,



—Official U. S. Navy Photo.

FIGURE 4.—Medical officer at observation port of a pressure chamber, School of Aviation Medicine, U. S. Naval Air Training Bases, Pensacola, Florida.

and a tendency to increased sinus arrhythmia with Cheyne-Stokes breathing appeared in some records. Six-foot films showed no change in either size or shape of the heart at increasing altitude.

As measured by capacity for work on the 20-inch step, exercise tolerance decreased in varying degrees in all subjects. In most instances the limiting factors were dyspnea or fatigue or both. Changes were noted with increasing altitude in the pre-exercise resting pulse rate, the peak rate attained during exercise, and the final rate after recovery from exercise. Administration of 100 percent oxygen at 20,000 feet markedly increased capacity for work, but the previous



—Official U. S. Navy Photo.

FIGURE 5.—Observer at observation port of a pressure chamber, School of Aviation Medicine, U. S. Naval Air Training Bases, Pensacola, Florida.

and subsequent sea level performances were not attained, and dyspnea and weakness were again the limiting factors.

Two of the men remained for 5 hours above 25,000 feet, of which time 20 minutes was spent at 29,000 feet, without supplementary oxygen; the other two required oxygen after 4 hours above 25,000 feet, at an altitude of roughly 27,000 feet. On the following day two men stayed for 1 hour above 45,000 feet, reaching 50,000 feet for a few minutes while using ordinary oxygen equipment. The altitude of 42,000 feet is commonly considered the ceiling for men using this equipment, and only a few men have remained for as long as a few minutes at 45,000 feet breathing oxygen under pressure. Furthermore the average duration of consciousness in unacclimatized man is less than 10 minutes at 25,000 feet, and less than 3 minutes at 29,000 feet. These two high runs, therefore, demonstrate that the men had increased their tolerance for high altitude, both with and without supplementary oxygen, by approximately 6,000 to 8,000 feet.

The measurements indicate that the men reacted to anoxia by an increase in pulmonary ventilation, which continued over a period of weeks and caused a lowering of the arterial carbon dioxide con-



—Official U. S. Navy Photo.

FIGURE 6.—Clinical observations in a pressure chamber, School of Aviation Medicine, U. S. Naval Air Training Bases, Pensacola, Florida.

tent, a decrease in alkaline reserve, and an increase in the alkalinity of the blood. These chemical changes, together with the increase in hemoglobin, sustained the arterial oxygen *content* at close to the sea-level value, and minimized the fall in arterial oxygen pressure and saturation.

Oxygen unquestionably improved the condition of all of the four men at rest, also increasing their ability to work; but even pure oxygen did not return the men to their sea level exercise performance. No absolute explanation of this may be given at present, but it is suggested that the fall in alkaline reserve becomes the limiting factor by reducing the buffering capacity of the blood. Accumulation of carbon dioxide and the resultant decline in pH then serve as stronger respiratory stimulants than is the case in sea-level man.

Despite excellent living conditions, adequate food and rest, the four subjects did not acclimatize to altitude either as completely or as rapidly as do mountaineers. The reason for this is not clear, but may be attributed to the confined quarters which made sustained and strenuous exertion impossible. At the higher altitudes the men spent much of their time at rest, and this undoubtedly decreased their work ability just as is the case in a patient confined to bed. Evidence was obtained suggesting that the ability to tolerate high altitudes may depend upon adaptation to the low arterial carbon dioxide pressure which results from hyperventilation and in turn raises the arterial oxygen pressure, content and saturation. In this way, acclimatized man, by lowering his carbon dioxide pressure with hyperventilation, is able to sustain his arterial oxygenation at a higher level than can an unacclimatized man.

It remains for similar studies in the future to investigate the value of various therapeutic, dietary, and other artificial methods of increasing tolerance for anoxia, since this project has merely added to the existing knowledge of those changes which occur normally.

REFERENCES

1. BARCROFT, J., CAMIS, M., MATHISON, C. G., ROBERTS, F. F., and RYFFEL, J. H.: Report on the Monte Rosa Expedition of 1911. *Philos. Trans. Roy. Soc.* 206: 49, 1914.
2. KEYS, A.: Physiology of life at high altitudes; International High Altitude Expedition to Chile, 1935. *Scient. Monthly* 43: 289-312, Oct. 1936.
3. HALDANE, J. S., KELLAS, A. M., and KENNAWAY, E. L.: Experiments on acclimatization to reduced atmospheric pressure. *Physiol.* 53: 181, Dec. 1919.
4. BOOTHBY, W. M.: Calculations relating to composition of respiratory gases. In *Handbook of Respiratory Data in Aviation*. National Research Council, 1944.

RHEUMATIC FEVER

A Statistical Analysis of Incidence During Sulfadiazine Prophylaxis

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From December 1943 to May 1944 at a large naval training center, sulfadiazine was given to groups of trainees as a prophylactic measure against streptococcal and other respiratory diseases. The general design of this program and the results obtained have recently been described elsewhere.¹ In the course of evaluating these results it became of interest to consider the epidemicity of rheumatic fever in the groups under observation. Since rheumatic fever is a disease which requires long-term hospitalization and which frequently leads to invalidism from military service, it was thought that the number of cases of this disease might serve as a more valuable index of the effectiveness of sulfadiazine as a prophylactic agent than would only the number of the more common short-lived respiratory infections. It was of further interest to study the symptomatology and clinical features of rheumatic fever in a group of young adults who had passed the preliminary screening at the military induction center and who, in many cases, were apparently having their initial attack of the disease.

MATERIALS AND METHODS

The center was divided into four regimental areas. Regiment I comprised the service schools. In this regiment the training period varied from 6 to 16 weeks. Regiment II was composed of negro recruits, and Regiments III and IV of white recruits. In these areas camp time of recruits varied from 4 to 6 weeks. The complement for Regiments I, III, and IV ranged between 4,000 and 5,000 men. There were between 2,500 and 3,000 men in the second regiment. Com-

¹ United States Navy Department, Bureau of Medicine and Surgery: *Prevention of Respiratory Tract Bacterial Infections by Sulfadiazine Prophylaxis in the United States Navy*. Superintendent of Documents, Government Printing Office, Washington, D. C., 1944.

panies of from 50 to 150 men each were selected at random from the first, second, and fourth regiments and placed on the various dosage schedules. This is shown graphically in figure 1.

Regiment III deserved special attention. This regiment was well isolated from the rest of the center. The recruit personnel were housed in 22 barracks and were not allowed near the other regiments.

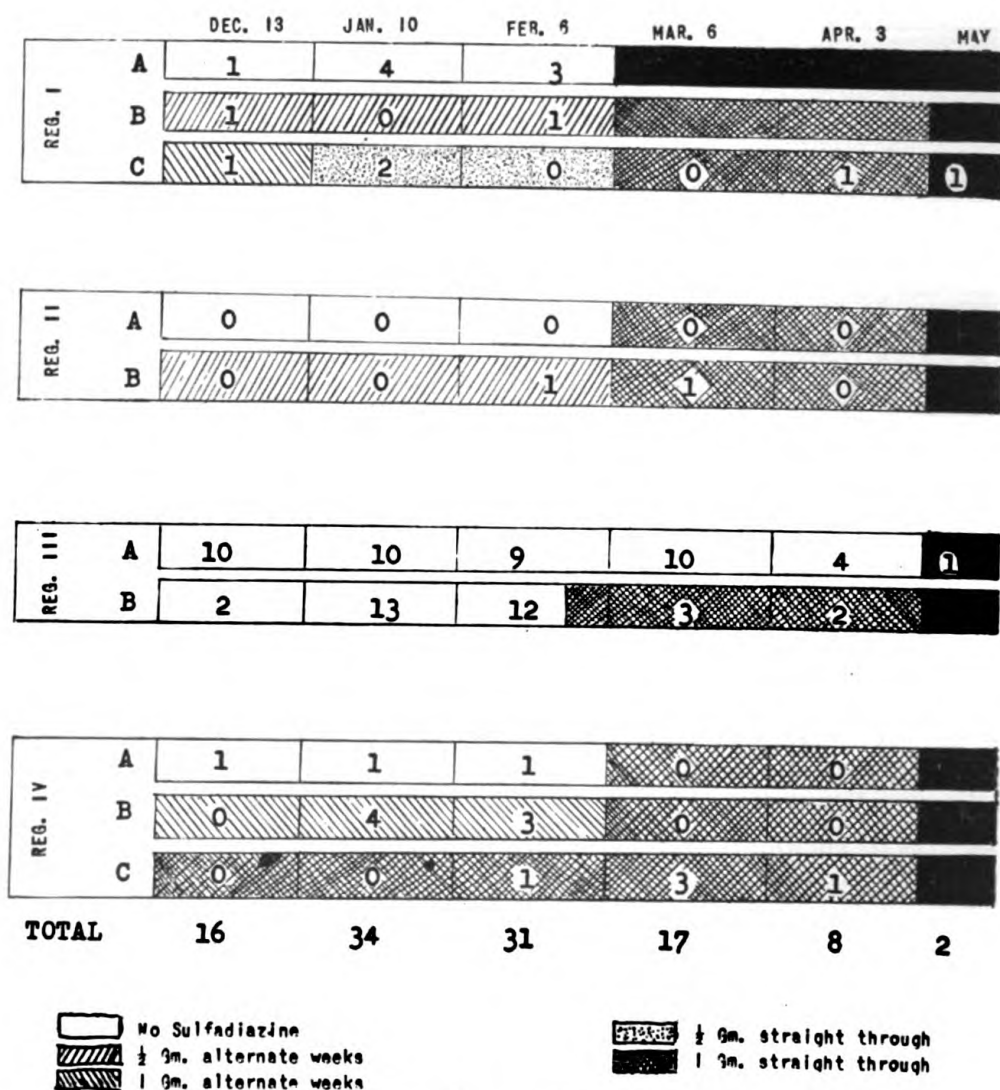


FIGURE 1.

The trainees from the south eleven barracks visited and utilized one dispensary, while those from the north eleven used the other dispensary. No sulfadiazine prophylaxis was given to the recruits who were housed in the north eleven barracks. The men in the south eleven barracks received one gram of the drug daily after 25 February 1944.

During the period of study there was a frank epidemic of streptococcal respiratory disease in this regiment.

In considering the time relation of a given case of rheumatic fever to his training schedule and his prophylactic schedule, difficulties were at once encountered. Arbitrary standards then had to be set. Thus, the patient must have been under prophylaxis for at least one week before he was considered suitable to be included in the group. Likewise, if he was in a control group, he had to be a member of that particular group for at least 1 week. If a man developed rheumatic fever within 4 weeks after being graduated from "boot camp" or from a service school he was entered in the group of which he was last a member. Men who developed rheumatic fever more than 4 weeks after graduation were not classified.

With very few exceptions these patients were interviewed and examined by one of us (J. B. S.), from one to several weeks after admission to the hospital. On most of them repeated sedimentation rates, white blood cell counts, and electrocardiograms were done. The criteria for diagnosis were the usually accepted ones for this disease, namely, fever, arthritis, cardiac findings, electrocardiographic changes, continued elevated sedimentation rates, elevated white blood cell counts, vasomotor disturbances, rheumatic nodules, and so on.

RESULTS

Table 1 shows the distribution of cases in the various groups for the 4-week periods (2 weeks in May). Since the population for the four groups for each period is very nearly uniform the seasonal case curve (fig. 2) also represents the trend of the seasonal rate curve. It

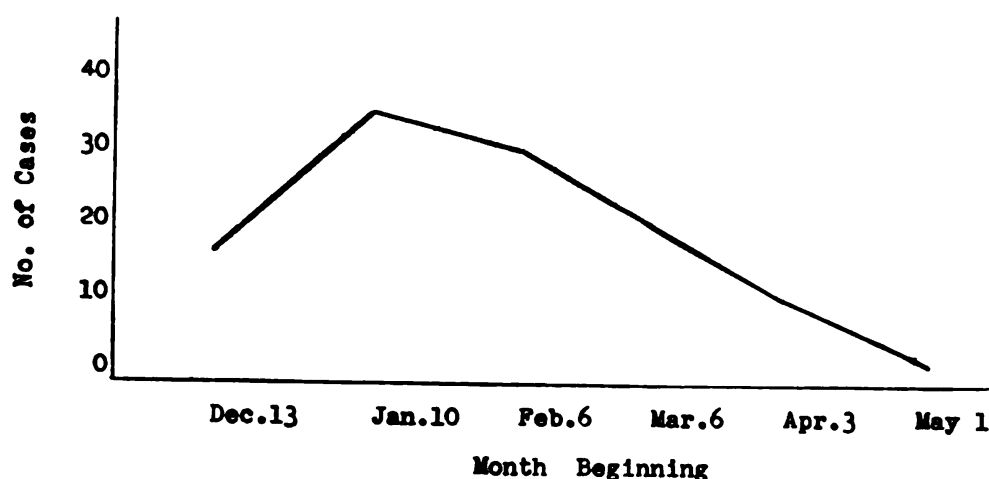


FIGURE 2.

is seen that the maximum incidence occurred in January and February. Since a number of patients developed rheumatic fever as long as 4 weeks after graduation, but are included in the month during which their group was graduated, a revision of table 1 must be made to give a strictly correct seasonal variation. This appears in table 2. The peak is at the same point (fig. 3).

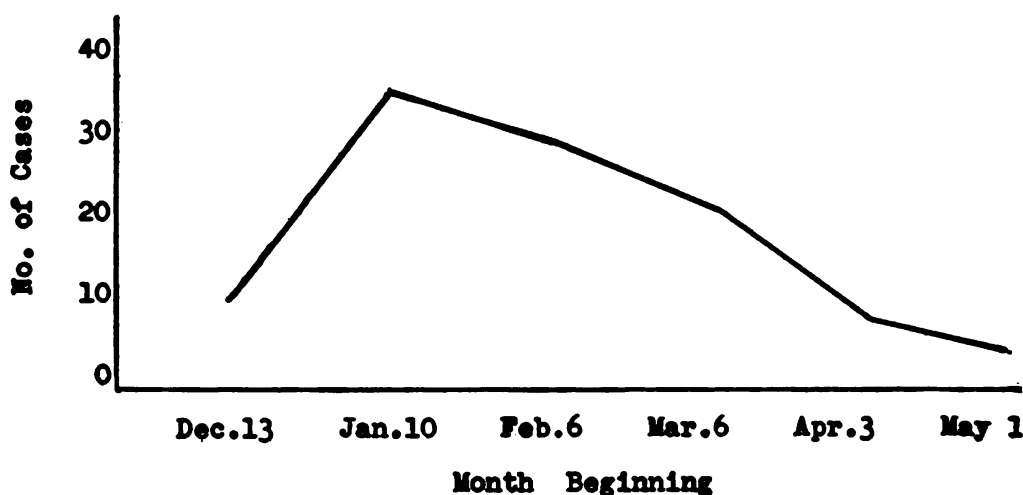


FIGURE 3.

TABLE 1.—Table showing cases of rheumatic fever developing on the various dosage schedules in the successive 4-week intervals¹

4-week period beginning	Regiment 1			Regiment 2		Regiment 3		Regiment 4			Total
	A	B	C	A	B	A	B ²	A	B	C	
Dec. 13, 1943	1	1	1	0	0	10	2	1	0	0	16
Jan. 10, 1944	4	0	2	0	0	10	13	1	4	0	34
Feb. 6, 1944	3	1	0	0	1	9	12	1	3	1	31
Mar. 6, 1944			0		1	10	3			3	17
Apr. 3, 1944			1		0	4	2			1	8
May 1, 1944 ¹			1		0	1	0			0	2
Totals	8	2	5		2	41	32	3	7	5	108

¹ The May period covers only the first 2 weeks of the month.

² Sulfadiazine in daily gram dosage was started in the southern half of the third regiment on 25 Feb. 1944.

TABLE 2.—Seasonal incidence of all cases according to month on onset of rheumatic fever

4 week period beginning	Total cases	4 week period beginning	Total cases
Dec. 13, 1943	10	Apr. 3, 1944	9
Jan. 10, 1944	34	May 1, 1944 ¹	5
Feb. 6, 1944	29		
Mar. 6, 1944	21	Total	108

¹ 2-week period.

TABLE 3.—*Relation of patients to their sulfadiazine schedule in the experimental group*

	Regiment I	Regiment II	Regiment III	Regiment IV	Total
<i>On schedule</i>					
1-2 weeks.....	2			3	5
2-3 weeks.....	2		1	1	4
3-4 weeks.....	2			1	3
4-5 weeks.....	2			1	3
<i>Off schedule</i>					
0-1 week.....		1		2	3
1-2 weeks.....				1	1
2-3 weeks.....	1		2	1	4
3-4 weeks.....			1	2	3

Table 3 shows the relation of cases to their drug schedule. The distribution appears to be random. Fifteen men developed their disease while still taking the drug; the other 11 became ill within 4 weeks after discontinuing their prophylaxis. Two confessed to taking the drug only about half the prescribed time. Two men were on the 0.5-gram daily schedule, 8 on the gram daily alternate-week schedule, 13 received the sulfadiazine every day in 1.0-gram dosage and 3 received it in 0.5-gram daily dosage, alternate weeks.

It is seen from figure 1 and table 1 that only a part of the treated and untreated groups were comparable. Thus, after the 6th of March there were no control groups in the first, second, and fourth regiments. If all the controlled groups are considered separately, a comparison of the cases of rheumatic fever in the treated and the untreated groups can be made. For purposes of this comparison the man-months of exposure in the groups were computed, the cases of rheumatic fever in the groups computed, and a significance test was applied to the two case rates. Table 4 shows these cases and the respective populations. It is seen that in the treated group there were 18 cases and in the untreated 26. The difference between these is significant below the 5 percent level.

TABLE 4.—*Rheumatic fever developing in experimental and control groups which were strictly comparable*

	Regiment I				Regiment II				Regiment III				Regiment IV			
	Treated		Control		Treated		Control		Treated		Control		Treated		Control	
	Number	Popula- tion	Number	Popula- tion	Number	Popula- tion	Number	Popula- tion	Number	Popula- tion	Number	Popula- tion	Number	Popula- tion	Number	Popula- tion
4 weeks beginning																
12-13-43	2	2,862	1	1,287	0	1,304	0	1,335					0	920	1	515
1-10-44	2	3,115	4	1,406	0	1,708	0	1,642					4	1,782	1	1,055
2-6-44	1	3,129	3	1,327	1	1,488	0	1,430					3	2,038	1	1,220
3-6-44																
4-3-44																
5-1-44																
Total...	5	9,106	8	4,020	1	4,588	0	4,407					7	4,740	3	2,790

	Cases	Population	Rate
Treated.....	18	25,177	0.715 per 1,000±.17.
Control.....	26	17,927	1.45 per 1,000±.28.

Standard error of the difference between these 2 percentages..... 1.33

Difference between these 2 percentages..... .73

Critical ratio (x/σ)..... 2.23

Probability..... 1.026

¹ For a percentage of this order of magnitude the standard error is the percentage divided by the square root of the number of cases on which the percentage is based.
² The chances are only 26 out of 1,000 that this difference would have happened by chance.

The bulk of the rheumatic fever occurred in the third regimental area. Since survey work for beta-hemolytic streptococcal carriers had shown this entire area to be heavily and quite uniformly blanketed with these organisms, it was of interest to note the distribution of cases of rheumatic fever in the barracks in this area. Consequently, cases were computed for each of the 44 barrack decks and the results analyzed statistically to show whether the distribution of cases followed the law of chance distribution for small numbers (Poisson distribution). It is seen that such is the case (table 5). This obtains, despite the fact that half this regiment was under sulfadiazine prophylaxis for about half the time. The theoretical curve coincides with the actual curve with a probability of 0.58. Hence, there was no "nesting" of the disease in certain areas.

TABLE 5.—*Poisson analysis of distribution of cases in the various barrack decks of the third regiment*

Number of cases per barrack deck	Frequency			$\Delta \cdot$	Δ^2	Δ^2/Σ
	Observed	Probability	Expected			
0.....	9	0.1778	7.82	1.18	1.392	0.178
1.....	14	0.3071	13.51	0.49	0.240	0.018
2.....	8	0.2652	11.66	3.66	13.396	1.147
3.....	7	0.1527	6.72	0.28	0.078	0.012
4.....	5	0.0659	2.90	2.10	4.410	1.521
5.....	1	0.0228	1.00	0	0	0
Total.....	44	0.9915	43.61	.....	.....	2.876

Since the mean and the limit, 44, are fixed, there are 4 degrees of freedom. This gives a probability of 0.58.

* In statistical analysis the symbol Δ denotes the difference between 2 variables.

* In statistical analysis the symbol Δ^2 denotes the difference between 2 variables squared.

* In statistical analysis the symbol Δ^2/Σ denotes the difference between 2 variables squared divided by expected.

A further objection to the comparison drawn in table 4 might be the one of eliminating the few cases from the treated groups, who for various reasons, failed to maintain their drug schedule. Such elimination might weight the treated group to such a degree as to establish a difference. This objection does not seem to be valid for the reason that the population on which the rate is obtained is a virtual one; namely it is the sum total of the individual dosages of sulfadiazine given during the 4-week period divided by 28 in the treated group, and the total number of man-days of training divided by 28 in the control group. By this device, there was eliminated that part of the population which furnished cases who refused prophylaxis.

Thus, it is believed that these results show, with a high degree of accuracy, that sulfadiazine diminishes the incidence of rheumatic fever when used prophylactically in large groups. It is true, however, that rheumatic fever will develop in certain individuals even though they have been taking sulfadiazine for days or weeks.

There are no inferences to be drawn from the fact that the cases in the third regiment were distributed randomly throughout the area. This distribution apparently contradicts the difference in rheumatic fever rates in treated and control groups. Consistency is established when it is recognized that a relatively small proportion of the total number of cases occurred in the third regiment during the last 10 weeks of the program.

DISCUSSION

The problem in the evaluation of the effectiveness of a sulfadiazine prophylaxis program revolves on the validity of the control groups chosen. If the tested and the control groups are not comparable, strictly and in every respect, it is then possible that the differences in results found in the experimental and control group be exactly comparable insofar as composition and history is concerned. The control group must be so chosen as to make all the influences, which bear on the experimental group, come to bear on it. Ideally it should be intimately and randomly interspersed with the experimental group. Unfortunately, administrative necessity rendered this impossible in many cases. Hence, large unit areas served as controls on other large unit areas which were experimental.

While, in general, we did not believe that the third regiment could serve as a control on the rest of the center, we felt it could legitimately be so used in a restricted sense, as presented in table 4. Some objection might have been raised to our having employed the north half of the third regiment, because of its relative isolation, as a control on the south half. This objection was minimized when it was realized that in the 12 weeks prior to instituting sulfadiazine prophylactically in the southern half of the third regiment, there were 29 cases of rheumatic fever in the northern half, and 27 in the southern half.

The third-regiment area was so thoroughly saturated with types 17 and 19 streptococci that it would seem almost impossible for individuals susceptible to rheumatic fever to escape the disease. If the streptococci had been more localized it is likely the rheumatic fever cases also would have been.

The clinical and laboratory features presented by these cases are very nearly what might have been anticipated. The incidence of heart involvement was higher than might have been expected in this age group. The high incidence (47 percent) of a strongly suggestive history points to the desirability of some form of selection of the rheumatic susceptible. This is not meant to imply that all men giving a history of rheumatic complaints should be rejected from military service; it does, however, indicate that a better method for the detection of these individuals might be devised.

SUMMARY

1. Sulfadiazine was given to large group of naval personnel as a prophylactic agent against streptococcal and related illnesses.
2. In the group receiving sulfadiazine, rheumatic fever was not eliminated, but the number of cases was diminished.
3. The law of chance scatter of small numbers (Poisson distribution) was found to apply to the incidence of rheumatic fever in the various barracks of the regimental area where the bulk of this disease occurred.
4. A pattern of rheumatic fever in a group of young male adults is described.



PROPYLTHIOURACIL FOR HYPERTHYROIDISM

A continued search for an antithyroid compound of high clinical effectiveness but unassociated with side effects has resulted in the selection of propylthiouracil. This compound has been used exclusively for more than a year and a recent analysis of the first 100 cases treated at the Pratt Diagnostic Hospital has shown that the use of this derivative of thiouracil is not attended by untoward side effects. Propylthiouracil is now being widely investigated in many clinics and it is already apparent that this substance is superior to thiouracil and that toxicity no longer need be a consideration in the choice of therapy.

When the diagnosis of hyperthyroidism has been made, propylthiouracil is given in a dose of 100 or 150 mg. daily. Severe cases, those with large nodular goiters, and those which have recently received iodine receive the larger dose, 50 mg. every 8 hours (e. g., at 7 a. m., 3 p. m., and 11 p. m.); this dose is continued until all symptoms and signs of the disease have disappeared and the patient has regained health and normal weight. Mild or moderately severe cases are given 50 mg. every 12 hours. This dose usually is sufficient; but in a few cases it may have to be increased to the larger dose if, after a month or so, progress seems to be unduly slow. Symptomatic improvement may be noted within a few days, but some individuals may require several months for the complete disappearance of all signs of the disease. When normal health has been regained, 75 gm. and later 50 mg. are given daily and the minimal maintenance dose consistent with continued euthyroidism is given for a period of at least 6 months. The majority of patients remain well if treatment has permitted a 6-month period of good health. A few patients experience a relapse after a single course of therapy and require a further period of treatment with the previously determined maintenance dose. There is no reason to believe that any harm results from long-continued therapy.—ASTWOOD, E. B., VANDERBLAAN, W. P.: Propylthiouracil for hyperthyroidism. *Bull. New England M. Center* 8: 143-144, June 1946.

SUBDIAPHRAGMATIC ABSCESS

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Infection beneath the diaphragm, or in relationship to the several surfaces of the liver, has been a fairly common postoperative complication following many types of abdominal surgery. Such infection has been especially associated with the peritoneal contamination from perforated peptic ulcer, appendicitis, or penetrating wounds of the abdomen with residual peritonitis. The high incidence heretofore observed is being decreased by the general use of penicillin and the sulfonamides; but it probably will not be possible to eliminate this complication entirely.

Following almost any type of abdominal surgery, but particularly gastro-intestinal, biliary tract, and traumatic surgery, a complicating subdiaphragmatic infection may arise. Signs of obscure infection may develop early or late during the postoperative period. When the more common sources of infection, such as a residual abscess in the field of operation, in the wound, in the urinary tract or the respiratory system, have been ruled out as the source of this systemic reaction, attention should be focused on the subdiaphragmatic region for a possible residual infection.

DIFFERENTIAL DIAGNOSIS

Types and degrees of infection.—There are many types and degrees of infection possible in this area: A mild diffuse perihepatitis in the form of a cellulitis may develop and subside under conservative measures and leave no residual abscess requiring surgical drainage. This type of infection, although potentially serious, may be only transitory.

Localization and drainage.—An abscess or multiple abscesses in any liver space beneath the diaphragm will menace the patient's life unless effectively localized and drained. If this type of infection is properly localized and adequately drained, the prognosis will be good and the incidence of mortality should be low. Exact localization of the abscess may be difficult and is one of the major aspects of this problem.

Differentiation.—Physical signs and roentgenographic findings are often minimal and confusing. The infection may often be localized

to this general area, but the accurate differentiation between (1) basal pleural infection, (2) subdiaphragmatic or perihepatic infection, (3) intrahepatic infection, and (4) subhepatic, perirenal, or perisplenic infection, may be extremely difficult.

Elevation and fixation of the diaphragm with basal pulmonary atelectasis and pleural reaction and effusion are usually present and further obscure the picture.

DIAGNOSTIC SIGNS AND AIDS

Sometimes pus presumably obtained from the pleural cavity during a thoracentesis is actually aspirated from beneath the diaphragm, and an erroneous localization is made. If the patient has pain in the top of the shoulder when the diaphragm is penetrated by the needle, this is diagnostic, and a mistake in localization need not be made. It is absolutely essential to be alert to this diagnostic sign of referred pain in the shoulder when the needle penetrates the diaphragm.

When signs of obscure infection develop after abdominal surgery, especially in conjunction with peritoneal contamination associated with a perforated viscus or appendix, a subdiaphragmatic abscess should always be considered. There may be no symptoms referable to this area, or at most, only vague discomfort in the low thoracic or subcostal regions. Deep tenderness may be demonstrated on pressure over the lower ribs, and the diaphragm will be elevated and fixed on percussion. As has been mentioned, there is likely to be some basal pulmonary atelectasis and pleural effusion as well, which makes it difficult to estimate accurately the height of the diaphragm or the degree of intrapleural reaction.

In the larger abscesses containing free gas, there may be hyperresonance to percussion with reduction of the liver dullness.

Roentgenographic examination.—The diagnostic procedure of greatest value is the roentgenographic examination in which the roentgenogram is taken with the patient in the upright and lateral positions to demonstrate a shifting collection of gas beneath the diaphragm. Certain common bacteria, notably the colon bacillus group, and mixed infections, may produce gas within the abscess which results in a characteristic roentgenogram that aids in diagnosis. When the shifting collection of gas cannot be demonstrated and the roentgenogram shows a diaphragm obscured by a basal pleural reaction, there may nevertheless be a subdiaphragmatic abscess; however, intrahepatic or even subhepatic abscesses, such as in the gallbladder bed or Morrison's pouch, will often give a similar picture. This has been observed repeatedly in cases of amebic abscess of the liver.

Aspiration.—In most instances the diaphragm rises high and the costophrenic angles and pleura are obliterated, so that a diagnostic

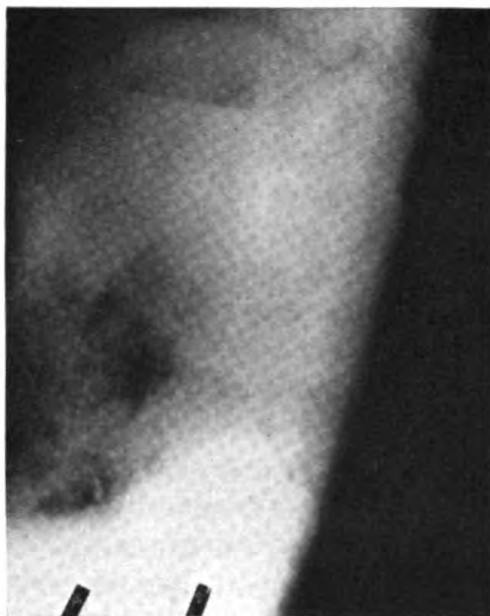


FIGURE 1.



FIGURE 2.

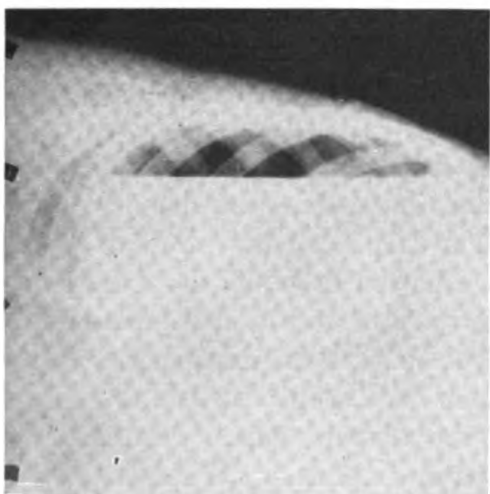


FIGURE 3.



FIGURE 4.

FIGURES 1, 2, 3, 4.—Collection of gas beneath diaphragm with a fluid level shifting with the patient's position: Figure 1 (Case 1): Lateral view with patient sitting upright. Figure 2 (Case 1): Postero-anterior view with patient upright. Figure 3 (Case 2): Postero-anterior view with patient lying with affected side up. Figure 4 (Case 2): Postero-anterior view with patient sitting in upright position.

aspiration in obscure cases is usually safe, especially if the patient is sick and undergoing a septic course, and his condition demands immediate localization of the infection and adequate surgical drainage.

Exploration.—A surgical exploration of the subdiaphragmatic region is justified in cases in which decline is rapid as a result of an obscure infection and in which roentgenographic studies and attempted aspiration have failed to yield an absolute diagnosis, but in which clinically there are indications that a subdiaphragmatic infection does exist. Exploration can be done readily under local anesthesia with virtually no risk to the patient. Left-sided subdiaphragmatic abscess, although not so common, does occur and usually is even more difficult to diagnose.

SURGICAL APPROACH

The surgical approach to the subdiaphragmatic region is through one of two routes: A posterior section of the eleventh rib or resection of the twelfth rib.

1. *Posterior space.*—A posterior section of the eleventh rib is resected, the lower costophrenic reflection of the pleura and of the diaphragm being crossed. This is a satisfactory and direct approach to the subdiaphragmatic space, but considerable care must be taken to prevent pleural contamination and pneumothorax, by either suturing or packing the pleura, if the pleura has not already been obliterated by the inflammatory reaction. Packing the pleura has the disadvantage of making a two-stage procedure of the operation, with several days' delay before the final drainage can be accomplished.

2. *Resection of twelfth rib.*—The alternative approach by resection of the twelfth rib and operating entirely extrapleurally overcomes the difficulties of the first approach but has the disadvantage that from this lower level a longer distance is required to reach and maintain drainage.

Drainage is maintained by either soft rubber chest tubing or cigaret drains with a small catheter for irrigation and instillation of penicillin.

Anterior space infection drainage.—Anterior space infections can be drained satisfactorily by a subcostal incision several inches to the right of the ensiform process, in which dissection is upward very close to the under surface of the rib in order to keep within the walled off area and to avoid entering the general peritoneal cavity.

SUMMARY

The diagnosis of subdiaphragmatic abscess may be extremely difficult, but can be arrived at by careful consideration of the clinical observations, roentgenographic studies, diagnostic aspiration, and, if necessary, exploration.

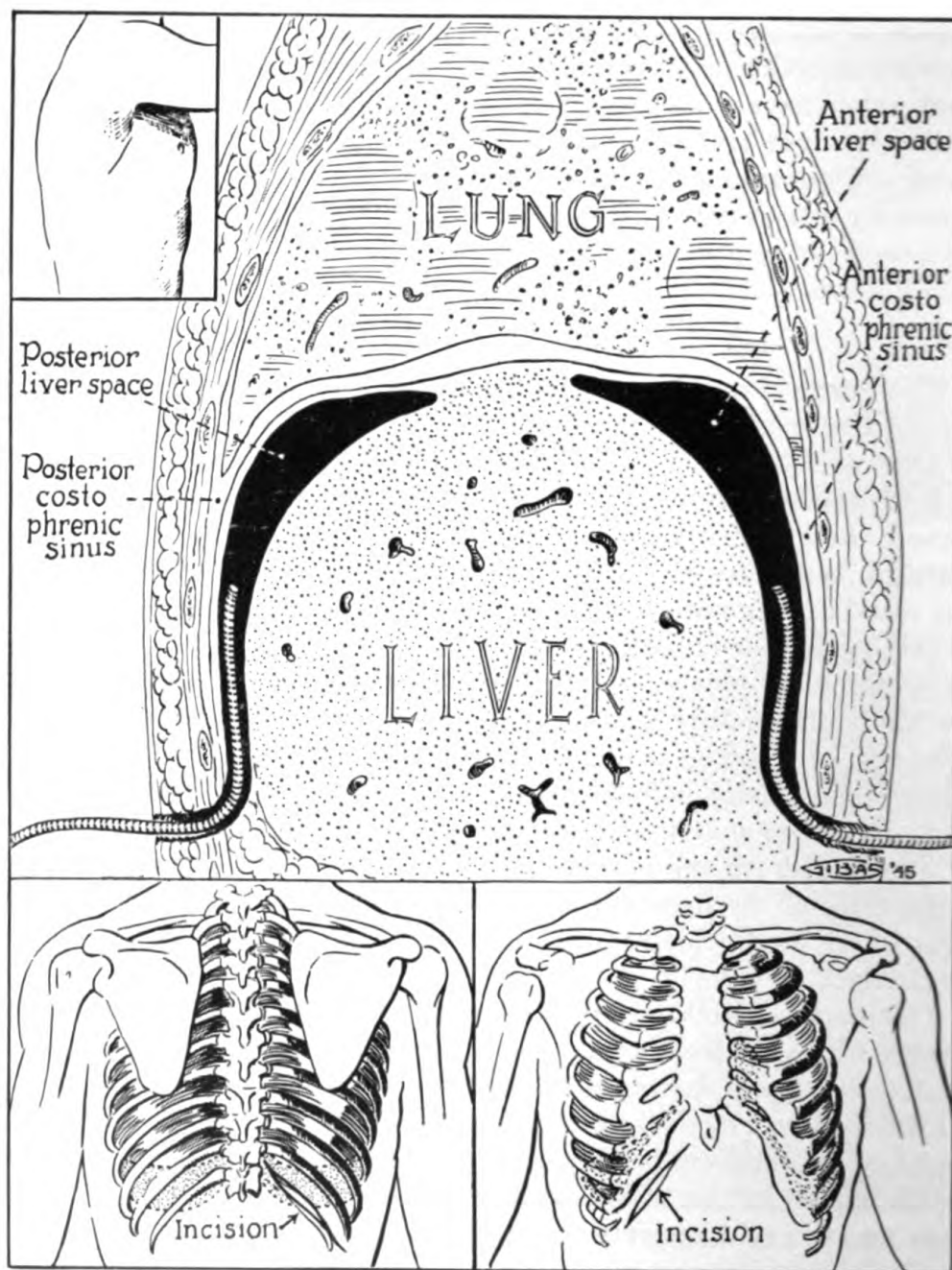


FIGURE 5.—Alternative approach: Twelfth rib resection.

Prevention is the best solution and can be accomplished only by early operation for the primary source of the infection.

In gastro-intestinal, acute biliary, and traumatic surgery, the serious complication of subdiaphragmatic abscess may be eliminated by: (1) Careful walling off of the area; (2) complete aspiration with suction of all contents spilled into the peritoneum and from over the dome of the liver; (3) the instillation of penicillin into these areas at the close of the operations; and (4) an adequate course of penicillin and sulfadiazine postoperatively.



TREATMENT OF HOSPITAL BLANKETS WITH OIL EMULSIONS AND BACTERICIDAL ACTION OF "FIXANOL C" (CETYL PYRIDINIUM BROMIDE)

Author's summary.—1. "Fixanol C," the active principle of which is cetyl pyridinium bromide, is an active bactericide against a large number of gram-positive and gram-negative organisms.

2. "Fixanol C," when incorporated in an oil-water emulsion and sprayed onto haemolytic streptococci dried on sterile fluff, rapidly kills these bacteria.

3. "Fixanol C," when impregnated into blankets in a concentration of one in 800 during an oiling process, imparts an efficient bactericidal action to blankets so treated.

4. Blankets treated with "Fixanol" and oil retain their bactericidal power for periods of at least 3 months.

5. The practical application of these results in the treatment of hospital blankets is discussed.—ROUNTREE, P. M.: Treatment of hospital blankets with oil emulsions and bactericidal action of "Fixanol C" (cetyl pyridinium bromide). *M. J. Australia* 1: 539-544, April 20, 1946.



ROCKY MOUNTAIN SPOTTED FEVER

Authors' comment.—The recovery of this child with clinically typical and serologically demonstrated Rocky Mountain spotted fever following administration of p-aminobenzoic acid was most dramatic. In an area where this disease presents a constant menace during the tick season, we have not previously seen so abrupt a subsidence of symptoms. While we cannot draw conclusions from an isolated case, it was our clinical impression that recovery was enhanced by the drug, and that it merits further trial.—MABONEY, J. W., DAVIS, H. C., and SCOTT, E. G.: Rocky Mountain spotted fever; case treated with p-aminobenzoic acid. *Delaware State M. J.* 18: 104-106, May 1946.

WEIL'S DISEASE

Report of Eleven Cases

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The outbreak of the disease occurred in a group of Marine enlisted men who were stationed in Zamboanga, Mindanao until 20 August 1945. Two hundred and forty-two men and 18 officers were in this group which came aboard this ship on 30 August 1945. Eleven of the men developed the disease, none of the officers.

Zamboanga possesses a rather heavy rat infestation, and rats were present in living quarters and mess halls. Rat fecal material was noticed at various times in the flour and sugar.

Weil's disease is caused by the *Leptospira icterohemorrhagiae* first described by Noguchi in 1914. This organism is present in rats the world over and is transmitted to man through the contamination of foodstuffs by the rat excreta. Rarely, a rat bite may be responsible for transmitting the infection.

The first man was turned into sick bay on 31 August, the last case on 19 September. The men reported that some cases of dengue fever had been present at Zamboanga, and due to the symptoms these cases presented this was used as the admitting diagnosis of the first case.

Pathological physiology.—Leptospirosis is a hepatorenal syndrome. Detweiler (1) states that the liver is usually unchanged in size, while Senekjic (3) found in his series of cases that the majority had palpable livers. In the majority of cases there is a moderately severe hepatitis, and in some it is quite severe. Icterus is due to partial biliary obstruction caused by the inflammation of the biliary ducts. Injury to the liver cells is present, but this is a reversible phenomenon. Hemolysis is not a causative factor in the production of the jaundice. The renal lesions are of toxic origin and the tubules are mainly affected.

Case studies.—The onset of the disease was rather sudden in 91 per cent of the patients. The initial symptoms consisted of chills, or a chilly sensation, followed by profuse perspiration and fever. These were followed by the complaints of severe headaches which were ac-

accompanied by very painful ocular moments in 82 percent of the cases. Myalgia and arthralgia were present in 82 percent of the patients. The myalgia was especially marked in the thighs, legs, and back muscles. Constipation was an initial symptom in 7 cases. Temperature went as high as 104° F. in one case—the fever usually was of a “picket fence” type; the greatest length of time fever persisted in any individual was 8 days, but usually the temperature remained normal after the third or fourth day. One man was afebrile throughout his whole illness. Nausea occurred as an initial symptom in 54 percent of the men, in 36 percent it varied in onset between the second and fourth day, and in 9 percent (one case) this symptom never appeared. Abdominal pain was present in 45 percent of the cases and in 18 percent there was initial pain in the right upper quadrant.

The later symptoms and signs consisted of vomiting, jaundice, biliuria, palpable liver, pruritus, and kidney involvement. Vomiting occurred in 91 percent of the men; this varied in onset between the second and sixth day of the illness, the average being on the fourth day. Clinical jaundice occurred in 10 cases, and in the eleventh there was a questionable trace of bile in the urine. Jaundice of the sclera was first noted, and within 12 to 20 hours it was plainly visible in the skin. The appearance of biliuria was synchronous with the onset of jaundice. Jaundice appeared between the second and eighth day of illness, the average being 5.2 days. Pruritus occurred in 18 percent of the men.

In this series the pulse and respiration were never high, even in the initial stages of the illness. A pulse of 94 with temperature 102 to 103 degrees F. was usual. This finding coincides with no other reports. The respiration was never above 22 in the most severely ill.

Respiratory symptoms and hemorrhagic phenomena did not occur, although these have been noted frequently in other series.

The blood pressure was never elevated in our cases. The systolic pressure varied between 104 and 118; the diastolic between 56 and 78.

The liver definitely became palpable in 78 percent of the cases. It extended 1 to 2 fingers' breadth below the costal margin. Usually the liver enlarged concomitantly or a day or two after the onset of the jaundice.

Laboratory findings.—Evidence of kidney damage occurred in 45 percent of the cases. Thirty-six percent had albuminuria, one patient showing a four plus for 2 or 3 days. Forty-five percent had red cells in the urine sediment; the man that ran the four-plus albuminuria showed hundreds of red cells at the same time. Casts were found in the urine of 18 percent of the cases. Bile was present in the urine of 91 percent of the men and a trace present in the one remaining man.

L. icterohemorrhagiae were found in the blood sera of 100 percent of the patients upon darkfield examination. No darkfields were done until either the onset of jaundice or the appearance of a palpable liver. Positive darkfields were found, even though the patient had been afebrile for 2 to 3 days. Darkfield examinations were done on four of the urines with negative results; this procedure was abandoned because it was felt unnecessary in the presence of positive blood-sera darkfields. Schultz (3) has observed pseudospirochetes arising from red blood cells, and he states that these can be mistaken for the leptospira by the inexperienced laboratory worker. Neither of us had ever seen a leptospira before these cases, and there is the possibility of our making a mistake; but we think it improbable, since all the organisms observed so closely fitted the description given by Strong (4). As a check, darkfields were run on other blood sera, but we were never able to find anything resembling this organism. Positive darkfields were obtained from 4 to 11 days after onset of illness; the average duration of the illness was 7.2 days before a darkfield examination was done and found to be positive. No agglutination tests for *L. icterohemorrhagiae* were run.

The hemotological findings (studies) were quite interesting. A leukopenia was present in 63.5 percent of the cases. This varied from a very mild to a rather marked drop in the total white count; one man had a total of only 3,250 cells. It was noted that the more seriously ill the patient was, the more marked the leukopenia. Also there was a relative lymphocytosis, the average count being 48 percent small lymphocytes, 34 percent polymorphonuclear leukocytes and 5.4 percent immature forms, and 2 percent eosinophiles, excluding one patient who also had malaria. The white-cell studies do not agree with those of other writers (3). A leukocytosis with an increase in the neutrophils and a shift to the left is the usual finding. In our patients with a marked leukopenia the count rose very slowly during convalescence and was still below normal when the jaundice biliuria had disappeared. (See table 1.) The sedimentation time (Cutler) was increased in most cases, the average fall per hour being 13 mm. Platelet counts and routine red counts were not done.

TABLE 1

Patient	Date 1915	W. B. C.	Segs.	Bands	Lymphs.	Monos.	Eos.	Basos.
G. D. F.....	3 Sept.	3,250	24	10	59	4	2	2
G. D. F.....	5 Sept.	4,900	21	8	62	8	1	0
G. D. F.....	7 Sept.	.....	42	2	46	7	3	0
G. D. F.....	19 Sept.	5,900	30	1	54	9	4	3
H. P. C.....	31 Aug.	5,300	69	2	26	2	1	0
H. P. C.....	3 Sept.	4,050	42	6	44	6	0	2
H. P. C.....	7 Sept.	.....	44	4	40	8	2	2
H. P. C.....	18 Sept.	7,700	44	1	47	4	1	0

Convalescence.—All 11 patients were able to be discharged and returned to light duty within 20 days of the onset of the illness. At the time of discharge they still had some visible jaundice and usually a palpable liver, but all were eating well, were afebrile, and were starting to regain the weight which was lost due to the anorexia and vomiting.

In reviewing the cases it was noted that the vomiting usually began with the onset of jaundice or a day or two before. Nausea and vomiting were usually the most marked the first 2 days of the jaundice and then gradually subsided. The nausea and vomiting disappeared on an average of 8.7 days after onset of illness. No oliguria or anuria was noted in any man.

Treatment.—Treatment for some of the cases was purely symptomatic. An attempt was made to maintain a high carbohydrate intake, but this was not particularly successful during the period of nausea and vomiting. As soon as these symptoms subsided, high carbohydrate, high protein diets were given. Adequate fluid intake was maintained in all cases, intravenous fluids being used if the patient was unable to tolerate fluids by mouth because of his vomiting. Penicillin, 40,000 units every 3 hours, was given to one patient for a total dosage of 720,000 units, and to the patient showing marked kidney involvement for a total of 420,000 units. No difference in the convalescence of these penicillin-treated patients and the non-penicillin-treated men could be observed.

It is claimed that the specific treatment of this disease consists in the administration of hyperimmune horse serum which must have an agglutination titer of 1:1,000,000 against *L. icterohemorrhagiae* and *Leptospira canicola*. The dosage is 60 cc. Convalescent serum in a dosage of 30 cc. and convalescent serum in a dosage of 500 cc. has been used with good results reported. If the convalescent serum is to be effective, it should have a titer of 1:20,000. None of this type of serum was available for our cases.

SUMMARY

A brief review of 11 cases of Weil's disease occurring in a group of 260 Marines has been presented.

1. These men were all stationed at Zamboango, Mindanao until 11 days before the first patient developed this disease. According to the histories given by the men this island is infested heavily by rats.

2. The onset of the disease was rather sudden in 91 percent of the cases. The initial symptoms consisted of chills, or chilly sensations, followed by profuse perspiration and fever. The complaints of severe headaches accompanied by painful ocular movements, myalgia, arthralgia, and nausea were noted early by most patients. The later signs

and symptoms consisted of nausea, vomiting, jaundice, biliuria, palpable liver, and kidney involvement. Ninety-one percent of the cases showed biliuria, and 78 percent a palpable liver. Evidence of kidney involvement occurred in 45 percent of the cases. No anuria or oliguria was noted.

3. A leukopenia occurred in 63.5 percent of the men. This varied from mild to moderately severe; the more ill the patient, the more marked the drop in the white count. A relative lymphocytosis accompanied the leukopenia.

4. A darkfield examination of the blood sera disclosed the *L. ictero-hemorrhagiae* in all 11 cases. This organism was demonstrated during the afebrile period in all patients. No agglutination tests were run.

5. Treatment was symptomatic. Two patients received penicillin intramuscularly for dosages of 720,000 and 420,000 units but their convalescence was no more rapid than the rest.

REFERENCES

1. DETWEILER, H. K.: Well's Disease, in Textbook of Medicine, CECIL, R. L., editor. 5th edition. W. B. Saunders Company, Philadelphia, 1942. p. 422.
2. SCHULTZ, E. W.: Pseudospirochetes derived from red blood cells. *J. Lab. & Clin. Med.* 8: 375-381, Mar. 1923.
3. SENEKJIE, H. A.: Clinical manifestations of leptospirosis in Louisiana. *J. A. M. A.* 126: 5-10, Sept. 2, 1944.
5. STRONG, R. P.: Stitt's Diagnosis, Prevention, and Treatment of Tropical Diseases, vol. I. 7th edition. The Blakiston Company, Philadelphia, 1943. p. 364.



NATURAL FUNGICIDAL PROPERTIES OF FATS AND OILS

Fats like cod liver oil, olive oil, and fat constituents like tristearin and glycerol inoculated with *Penicillium glaucum* and kept at 25° show no sign of mold growth even after 5 months. The growth inhibition can be removed by adding an inorganic nutrient salt mixture to the latter two and a small amount of Ca oleate to the oils. Other oils contain definitely fungicidal substances: sorbinol, a normal constituent of fruits, seeds and oils as blastokollin, will in dilutions of 1:1000 inhibit growth of *Penicillium glaucum* on the most favorable media. It is also bactericidal (Kuhn, et al., *C. A.* 38, 2998).

RUDOLPH, W. (Reichsforschungsanstalt Lebensmittelfrischhaltung, Karlsruhe): Natural fungicidal properties of fats and oils. *Naturwissenschaften* 32: 302, 1944; *Chem. Abstr.* 40: 3155, June 10, 1946.

NEUROPSYCHIATRIC PROBLEMS ON A BATTLESHIP

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This article is a review of some of the problems of neuropsychiatric disease, as encountered aboard a battleship which has been overseas and engaged in operations against the enemy for 31 months, and of the efforts of the medical department to cope with it. It is based on a study of over 100 cases. It is felt that a description of the nature of the diseases encountered and the results of our efforts to treat them may be of value to medical officers assigned to shipboard duty as well as to hospital personnel to whom such cases are referred.

NATURE OF THE NEUROPSYCHIATRIC DISEASES ENCOUNTERED

It became apparent to the present medical officers, soon after they came aboard this ship, that one of the major medical problems with which they were faced was that of dealing with a large number of men who came to sick call repeatedly with a plethora of complaints, for which no "organic" cause could be found, and for which no medical treatment seemed to avail. A record was kept on each of these men. Each was seen by a medical officer on several occasions. A thorough history was taken on him, and a physical examination was done. Various laboratory tests were performed in cases in which they seemed indicated, to the limit of the capabilities of a ship of this type. Some men were sent to hospitals or hospital ships for consultations on doubtful points. Others were kept in the sick bay for observation or treatment, as indicated. In this manner a large number of cases were investigated. Because we have kept a file card on every man who came to sick call, we know that during the past 18 months we have seen fully 80 percent of the crew at one time or another, and that nearly all of the men aboard who had neuropsychiatric complaints have been studied.

It became evident to us that in nearly all of our patients we were dealing with what is basically a single syndrome, with variations on the theme. It was easily diagnosed in most cases, and the diagnosis made upon a "positive" basis, and not by exclusion. It was, in our

opinion, essentially an "anxiety syndrome" and substantially the same as that which was called the "effort syndrome" in World War I (1).

These patients, as they appear in the sick-call line, have a characteristic "sad and worried look." They seem tired, dejected, and at the same time suspicious, and anxious to convince the doctor of the reality of their symptoms. Their presenting complaint may be any one of several: Epigastric distress and nausea, restlessness and nervousness, pain around the heart, recurrent headache, or chronic fatigue. Sometimes they present themselves with a clearly hysterical paralysis, or with symptoms referred to an actual organic illness of a minor nature—classically "flat feet" or "backache."

Regardless of the initial complaint, careful questioning and a system review will reveal that all of them also have either all or several of the following symptoms, which are here enumerated:

Headache is very common, and seen in nearly all of these men. It may have any form: Constricting, squeezing, temporal, frontal, occipital, "like a pressure right here," or a mixture of several forms. Localizing signs suggestive of intracranial disease are absent, although the patient often attributes it to his "sinuses" or his "constipation." It is recurrent, and usually has been present since childhood.

Precordial or presternal pain is very common also. It is described as "sticking" or "constricting," and is usually localized just over the apex of the heart. It is not severe, but it is recurrent and alarming. Sometimes it is described as "all over the left side." It almost never radiates in the manner of angina pectoris, and it is never related to exercise—in fact, exercise often will abolish it. Patients often complain of a "feeling of gas around the heart." In addition, they frequently say they have "pounding of the heart," which is generally noticed after slight exertion, but classically occurs just after they have gone to bed. When a man says, "Doc, I can't go to sleep because my heart pounds, and I can't lie on my left side at night because it bothers me so," the complaint is almost pathognomonic.

These people have frequent *sighing respirations*. They often find it *difficult to breathe* (especially in closed, warm spaces) and say that they "can't take a deep breath." They also complain of *dizzy spells* when they arise suddenly from a sitting or lying position. *Fainting* is not uncommon among them.

Probably the most common single initial complaint of our patients is *epigastric distress* in some form. Usually it is described as a "burning" or "gripping" pain, located in mid-epigastrium, and usually, but not always, postprandial in occurrence. Sometimes it is relieved by food and soda, and often it is accompanied by sour eructations and heart-burn, so that only an x-ray can establish the absence of a peptic ulcer. On the other hand, it is so often accompanied by *morning*

nausea, dislike for the sight of food, a *poor appetite*, and intolerance for unusual foods (asparagus or pineapple juice, for example) that the differentiation may be suspected from the first. In addition to the gastric symptoms, *spastic constipation* is not uncommon, and a "lump in the throat" is occasionally complained of.

Urinary symptoms are not common, but occasionally one sees a man who complains that he has to get up several times at night to urinate, or that he has to do so frequently in the daytime. Questioning will reveal that he passes only a small amount of clear urine each time, that there are no other urinary symptoms, and that there is no history of urinary disease. The urine is normal on examination.

Almost without exception these patients *sleep poorly*. They say that it "takes at least an hour to get to sleep." They are often night-owls, who stay up until very late because they are "not sleepy." Usually they sleep lightly, but not always. Often they complain of *nightmares* or weird dreams. Almost universally they have *morning fatigue*. It is very rare to find one who does not say that he is "tired" when he wakes up. When a man complains that he is "tired" when I get up than when I go to bed," one can almost make the diagnosis forthwith. This morning fatigue is often accompanied by a feeling of weakness, which wears off during the day, leaving the patient feeling all right in the afternoon.

In the daytime these people are restless, and often irritable and excitable. They "can't sit still." Frequently they cannot tolerate crowds or closed spaces.

A small or finicky appetite is common among them, and it is very rare that one is found aboard this ship who does not *smoke excessively* and drink large amounts of *coffee*. It is not unusual to find a man who drinks 20 large mugs of coffee each day, and smokes 2 packs of cigarettes.

The *physical examination* correlates well with the history. It reveals an unhappy and worried man, with a generally hyperactive autonomic nervous system. A sad face is so usual among patients of this sort that the hospital corpsmen have nicknamed them the "long-faced men." There is a fine tremor of the outstretched hands; the palms are moist and clammy; there is axillary sweating, even in a cold room; the pulse may be very rapid, but usually it is about 80 or 90, and of small volume. Sighing respirations may be seen. Epigastric tenderness often appears in those who complain of epigastric pain, and a spastic colon can be palpated in some who have spastic constipation. Hyperactive deep reflexes appear about half of the time.

The widespread notion that people with symptoms of this type have an "asthenic" body build has proved in our cases to be entirely erroneous. It is true that there are many of them who are tall, thin,

and slack-muscled; but the fat, the chubby, and the robust are just as common as the thin.

The *past history* and the *family history* are almost without exception significant. They will be discussed at greater extent later. Suffice it to say here that it is rare to find a patient with this syndrome who does not give a past history of various prodromal nervous stigmata in childhood, and who does not give a family history of having had one or both parents with similar symptoms, and of having been raised in a disrupted home in which parental love and guidance were lacking; and there is hardly one of them in whom some deep seated conflict or insecurity cannot be discovered.

There can be no doubt that we are dealing with a true psychosomatic syndrome. *Laboratory tests* confirm what the history and physical examination suggest. In the patients with "epigastric distress" a high gastric acidity often can be demonstrated. The very anxious ones sometimes run an afternoon temperature of 99.4 to 99.8 as they lie in bed in sick bay (2). Those with circulatory symptoms show poorly compensating cardio-vascular systems, with persistent tachycardia after slight exercise; others, paradoxically, show a fall in pulse-rate several minutes after exercise. Those who smoke excessively sometimes have ventricular extrasystoles. A physician who persists in seeking an "organic cause" (in the usual sense of the word) for the complaints of these patients will find enough "red herrings" to keep him busy and suspicious for months.

The diagnosis is always made upon a positive basis, not upon a single symptom, but upon the presence of the whole syndrome. It can almost be said that regardless of the type of psychoneurosis present this syndrome can be found in whole or in part. An unhappy and irritable man is seen. He has one of the common presenting symptoms, such as epigastric distress. The history shows that he has been restless also, that he sleeps poorly, awakens tired, has headaches, is constipated, and smokes heavily. He is sweating in his axillae, and there is a fine tremor of his outstretched fingers. He has "always been a little nervous." He was a shy child. His mother had a nervous breakdown. Physical examination and laboratory tests are as previously described. Such is the usual patient.

The knowledge of the significance of this syndrome has greatly facilitated the diagnosis of many cases. "Pain in the leg" after an alleged "fall," can be suspected of being hysterical from the very first, if this syndrome is present. A few days of observation and neurological tests will usually rule out ruptured intervertebral disc and other organic lesions. "Backache" or "flat feet" to which intolerable—and intractable—symptoms are referred, can be recognized as a "fixation" symptom, if the anxiety syndrome is also present. Even

though there is a slight functional scoliosis, or moderate pronation of the feet, it can be recognized from the first that psychiatric as well as physical treatment will be necessary to effect a cure.

Of course, one must never forget the true "organic diseases" which the syndrome simulates. Hyperthyroidism and peptic ulcer must always be considered, and ruled out. Perhaps these diseases differ from this syndrome more by degree than by nature, and develop from it. Organic heart disease must be sought for and suspected. Intracranial neoplasm and chronic sinusitis may be present in those with headache or they may have migraine, or any one of the many other causes of headache. And of course there is nothing to prevent a patient with the anxiety syndrome from having an "organic disease" also. However, if the nature of the syndrome and its specificity is recognized from the first, many fruitless laboratory procedures are avoided. There are probably a very great many men in the Navy who are receiving prostatic massages, wearing orthopedic shoes, or undergoing extensive x-ray studies, who could be helped more by firm but kindly explanation of the nature of their symptoms, and an attempt to help them adjust to Navy life.

Actually, this anxiety syndrome is only the somatic expression of a psychic disorder. In every case the history reveals the patient to have had either some pre-existing evidence of psychic instability, or a profound and recent psychic trauma (such as the sudden revelation of a wife's infidelity). However, we have resisted the temptation to hang the label "psychoneurotic" on these men, despite the fact that if we had to admit them to the sick list, perhaps 95 percent of them might be so diagnosed. Most of them were outwardly well adjusted in civil life; nearly all of them, as we shall show, have made adequate sailors. Although their symptoms may be regarded as "psychoneurotic," their illness is usually not profound enough to warrant the diagnosis "psychoneurosis." Nor do they have true "operational fatigue," as we shall show also. We have found it to be a grave therapeutic mistake, in most cases, to give a man either of these diagnoses and admit him to the sick list. It only convinces him that he is a "sick man." It gives him a peg to hang his hat on.

Most of these patients have simple anxiety states, which are amenable to ambulatory shipboard treatment.

NATURE OF THE SERVICE TO WHICH THESE MEN WERE EXPOSED

The men in whom these diseases appeared were members of the crew of a ship which has been overseas for 31 months. It has taken part in 11 Pacific campaigns, 7 shore bombardments, and 1 major fleet action. It has been under air attack perhaps half a hundred times. During nearly all of this period it has been operating in tropical

waters. It has been hot and crowded. Its crew has stood a "watch in three" for months on end. Cruises of up to 6 weeks duration have been broken only by a brief stay in some bleak Pacific atoll, during which ammunition loading and repairs were constantly under way. A man who has been aboard for the full 934 days of operation will have had a total of 914 hours, or 38 days, available for recreation off the ship (on some small tropical sandpit on which recreation consists of a swim and 3 cans of warm beer) and 21 days' leave in the United States.

For all this, the service aboard a ship of this type is comfortable compared to that aboard most other vessels. Creature comforts—warm food, a varied diet, ice cream, moving pictures, laundry service—are never lacking. "Safety" is as great as can be found upon a combatant ship. Utter boredom and chronic fatigue, however, these men share with all other men at war, and in no less measure.

Are these men suffering from operational fatigue?

In 98 percent of our cases, the symptoms were found to be "service aggravated"—that is, they are worse now than they were when the individual came into the service.

On the other hand, in what sort of people have these symptoms appeared? In 87.3 percent of our cases there was a past history of neuropsychiatric symptoms before entry into the service. Either they had their present symptoms in a milder form (most of them did), or they showed those childhood and youthful stigmata which are generally agreed to predispose to neuropsychiatric disease: Excessive shyness, night terrors, sleepwalking, bedwetting, inability to adjust to school, a high truancy or juvenile delinquency record, running away from home, changing from job to job without sufficient cause, and so on; most of them had the childhood stigmata, and their present symptoms as well, before their induction. In addition, 86.3 percent of them had a family history conducive to neuropsychiatric disease, in the sense that it showed one or more of the following: One or both parents who were extremely nervous or had a "nervous breakdown"; a home broken by divorce, infidelity, the early death of a parent, alcoholism, or some similar cause; or the absence of parental supervision and affection for the child. In 78.4 percent of the cases both the family history and the past history were positive. Only 5.9 percent of the cases were negative in both respects; about half of these were considered "reactive depressions," and the remainder consisted of boastful, resentful, and un-cooperative individuals who are suspected of concealing a part of their history.

Neuropsychiatric disease on this ship has appeared almost entirely among the predisposed.

TABLE 1.—*Incidence of neuropsychiatric disease*

Total time overseas	Percent of patients	Percent of crew
31 months or more ¹	38.6	35
17 to 31 months.....	12	20.1
Less than 17 months.....	49.4	44.9

¹ The incidence is just as high among those who have been aboard less than 5 months.

Prolonged duty of this type *per se* does not appear to cause neuropsychiatric disease. The incidence of neuropsychiatric disease is shown in table 1. It can be seen that neuropsychiatric disease is no more common among those who have been aboard 31 months, than among those who have come aboard recently.

An investigation of the histories of our patients shows that the causes of their anxiety were these, named in the order of their importance: (1) Anxiety over the family situation at home; (2) sexual (i. e. "love") conflicts; (3) inability to adjust to the shipboard routine and to "get along" with their shipmates and petty officers; and (4) worries about personal health. Not over 5 percent admitted to any anxiety over their own safety, although perhaps 25 percent admitted having nightmares about the ship sinking, etc.

It is not permissible to give figures for patients hospitalized, but it can be said that of those patients sent to the hospital from this ship during the past 18 months for neuropsychiatric disease, only one showed a negative past history, and had clearly been through enough strenuous action (on another ship) to warrant the belief that the symptoms had developed *de novo* since entry into the service.

A careful evaluation of all of our cases by rate and division showed only one type of duty aboard this ship which might be conducive to true "operational fatigue"—that of radioman. The incidence of anxiety states among these men was about twice as high as among the rest of the crew. Positive family histories were present, but not as striking as in most other cases. There is no doubt that the work of the radiomen is gruelling. They stand one 8 hour watch in three, guarding the circuits. During these watches they spend alternate hours copying code at a rapid rate, a job which requires the utmost speed and concentration, and the remainder of the time transcribing what they have taken down, another job requiring great attention to detail, although it is regarded as a "rest" from taking code. Their work goes on in port just as it does at sea; sometimes it is heavier in port. It continues Sundays and holidays without a break. A high degree of nervous fatigue develops among the operators, and even those who are not susceptible to the development of anxiety states become stale and tired.

TREATMENT USED, AND RESULTS OBTAINED

The treatment of these cases has been of the simplest sort. The medical department of this ship does not include a specialist in psychiatry, and no complex psychiatric therapy was attempted. We tried merely to enable these men to carry on and to be effective sailors, and to prevent their illness from reaching proportions which would require hospitalization.

By the time each man had told his whole history, including the nearly always significant family and past history, the nature of his symptoms was usually suspected by him. The first move was to explain his condition to him and the causes of it. If necessary, several discussions were held with him. He was told that his symptoms were annoying, but that they were common to his condition, and would not hurt him. It was impressed upon him from the very first that he was not really "sick," and he was assured that he would be *treated aboard this ship, and that he would get better as time went on*. Such family problems and financial difficulties as could be alleviated by arrangement with the chaplain and various relief agencies at home were so attacked, and conflicts within the man's division were ironed out where it seemed wise to do so.

However, these people are of such nature that if one of their problems is removed they will usually find another to worry about, and the result of this line of treatment has not been gratifying in most cases. Their main conflict is with military life, and cannot be removed if they are to be retained in the service.

Further therapy to the patient himself was on physiological lines. Men who were acutely upset and "jittery" were admitted to the sick bay for several days and sedated with barbiturates until they had "cooled off." It was explained to them that cigarettes and coffee only increased their "nervous tension," and they were given stern orders to "cut it out." Of course, very few of them actually stopped smoking, but most of them gave up the coffee and cut down the cigarette consumption materially, to their great benefit. They were also told of the necessity of getting some form of relaxation in the afternoon, preferably physical exercise, to "take the steam off" and make them sleep better. They were urged again and again to exercise, no matter how "tired" they felt. If they had been shore based, instead of being aboard ship where it is difficult to obtain exercise in any form, doubtless we would have had better results with them. As it turned out, those who actually did exercise found that the increased "physical fitness" of their cardiovascular system greatly decreased their distressing pounding of the heart and extrasystoles, and "improved their wind"; they were more physically tired at bedtime, slept more soundly, and awoke less fatigued.

Unless the case proved intractable to all other forms of therapy, we attempted to avoid the use of medications. The reduced consumption of coffee and cigarettes, the avoidance of the most highly seasoned foods, and increased rest and exercise, went a long way to abolishing "epigastric distress"; the symptoms which remained usually responded to one or two "soda mint" (flavored sodium-bicarbonate) tablets after meals. The constipated were not given laxatives; they were told that it would not hurt them if they had a bowel movement only once in 2 days, and it did not. Every effort was made to prevent them from worrying about their health. They were always encouraged to stop worrying about having an ulcer, and "let the doctor worry about it." Only occasionally were men given phenobarbital. It was found that sedation, except for men confined to the sick bay, was unsatisfactory.

From the point of view of enabling these men to "carry on" and become adequate sailors, our results have been eminently satisfactory. Only 5.4 percent of our patients have received quarterly marks for proficiency in rate which were below 3.0. Ninety-five percent of them received grades above 3.5 in conduct, and 81.6 percent of them were marked 4.0. The number of courts-martial and captain's masts awarded them was no higher than those which would usually be awarded to a random sample of the crew.

On the other hand, they might still be labeled "psychoneurotics" if we wished to do so. Their basic nature is unchanged, and unfortunately, their symptoms often persist; but most of them have developed insight into their condition, and have adjusted their conscious thoughts, at least, to staying out here and "getting on with the war."

The following tables indicate the response of our patients to treatment, with respect to insight and alleviation of symptoms:

TABLE 2.—*Insight and conscious adjustment to "carrying on"*

Degree of insight	Percent of patients	Degree of insight	Percent of patients
None	5.8	50 percent to 90 percent	32.6
50 percent or less	15.1	90 percent or more	46.5

TABLE 3.—*Alleviation of outward symptoms*

Degree of alleviation	Percent of patients	Degree of alleviation	Percent of patients
Symptoms worse	3.5	50 percent improved	25.6
Not improved	18.6	75 percent improved	16.3
25 percent improved	24.4	90 percent improved	11.6

We are particularly impressed by the improvement made by our patients with hysterical "paralyses" and paresthesias. We have seen 13 of them. One was hospitalized. The remaining 12 are still aboard, every one of them has recovered entirely from his hysterical symptoms, and has remained free of them over observation periods of up to a year.

CONCLUSIONS

1. Regardless of the neuropsychiatric names by which it may be called, the neuropsychiatric disease seen aboard this ship is largely in the form of a psychosomatic anxiety syndrome, and it is not of a severe nature. It can be diagnosed on a positive basis from the history and physical examination.

2. The vast majority of the neuropsychiatric problems which are present aboard this ship have appeared only in men who can be shown to have had neuropsychiatric symptoms previous to their induction.

3. Except in the case of radiomen, there is no evidence that the neuropsychiatric disease which has developed aboard this ship has been caused by the strenuous nature of the duty to which the men have been subjected. The provoking cause is the removal of a susceptible individual from his civilian environment and his introduction into a new environment to which he must adjust.

4. Proficiency, conduct, and punishment records on neuropsychiatric patients show that these men, as treated aboard this ship, have made satisfactory sailors. In this connection, however, it must be admitted that this ship has never had to face the ordeal of suffering heavy casualties, and the performance of these men under such circumstances has not been tested. They have performed well in many air attacks, some of which were pressed home with vigor. Less than 15 percent of those which we have attempted to treat have had to be hospitalized because of failure.

REFERENCES

1. JONES, M. and SCABISBRICK, R.: Effort intolerance in soldiers; review of 500 cases. War Med. 2: 901-911, Nov. 1942.
2. FRIEDMAN, M.: Etiology and pathogenesis of neurocirculatory asthenia; hyperthermia as one of the manifestations of neurocirculatory asthenia. War Med. 6: 221-227, Oct. 1944.

THE WARTIME LOG OF A UNITED STATES NAVY HOSPITAL SHIP TO 30 JUNE 1943 ¹

Part II

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MEDICAL EXPERIENCES

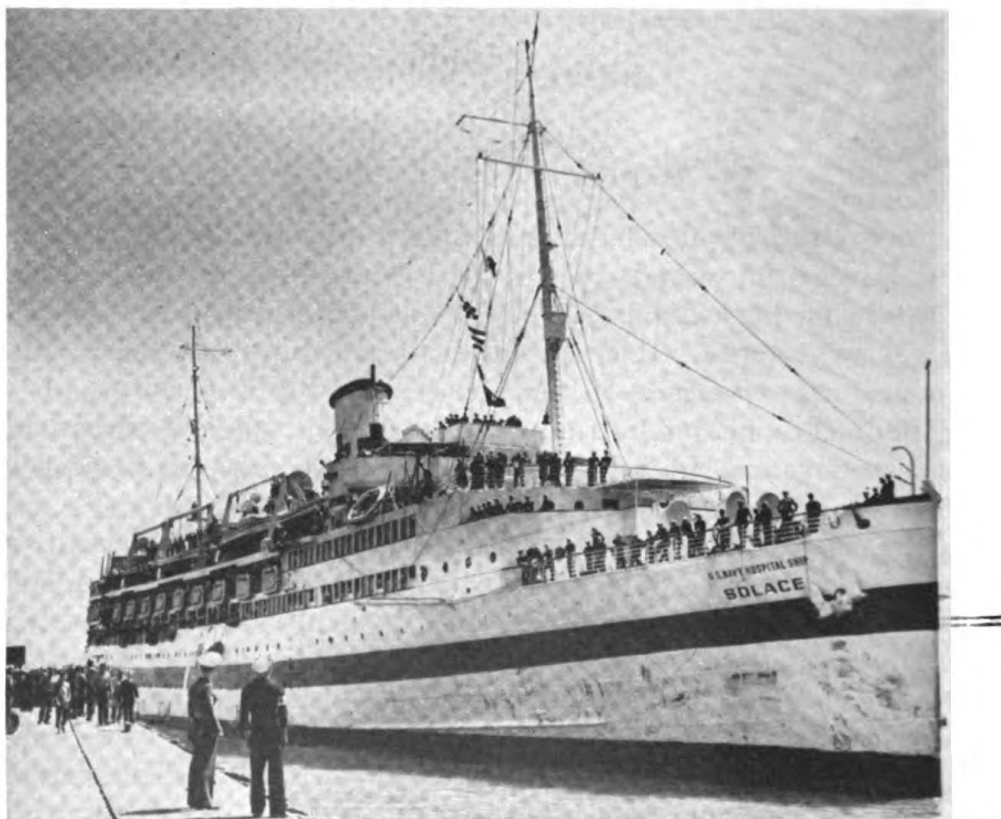
Contact with over 10,000 patients, more than 7,000 of whom came aboard because of wounds or illnesses sustained in a combat area, afforded the medical staff a wealth of clinical observations that should be of general interest. It is not our intention to go into the details of our medical experiences in this report; that has been done and is being done through publications by the various medical officers in their respective special fields. However, we do wish to present a brief survey of the highlights of these medical experiences.

On the *Surgical Service* the experiences with the battle casualties are of major interest. It here becomes necessary to interject a few statistics: Between 14 August 1942 and 7 April 1943, the *Solace* acted primarily in the capacity of an evacuating vessel. During that time 7,879 patients were admitted to the ship. Of these, 7,497 were transferred as patients to medical facilities in the rear areas, 366 were discharged to duty, and 16 died. Of those transferred as patients, 4,331 were surgical cases and 3,223 were medical. Of the 16 patients who died, 13 were surgical cases and 3 medical.

If one excludes the 262 patients admitted on the eye, ear, nose, and throat service, there remain 4,069 cases evacuated through the surgical service. Thirteen surgical patients died, 10 from the result of battle wounds, 1 from burns sustained in battle, 1 from a plane crash, and 1 from intestinal obstruction (a patient previously operated upon and transferred to us with a double-barrelled intestinal fistula). This represents a mortality among all surgical cases of 0.3 percent, and of only 0.25 percent among the battle casualties.

¹ This is the second of the four parts in which this article is being published. The third part will appear in the next issue of the BULLETIN. The list of references will follow the fourth installment.

A break-down of the 4,069 surgical cases discloses some interesting figures. Gunshot, shrapnel, and other wounds were present in 1,903 patients, gunshots accounting for 1,513. Fractures were seen in 775 patients, and in 476 of these the fracture was compound. In addition there were evacuated 72 patients with amputations. Therefore, the Surgical Service had an experience of over 2,400 patients with battle wounds. The wounds in so many patients were multiple that this figure may at least be doubled in estimating the number of individual wounds treated.



—Official U. S. Navy Photo.

U. S. S. *Solace*

The surgical observations on battle casualties treated on board this ship have been reported in detail in the U. S. Naval Medical Bulletin by Commander L. Kraeer Ferguson and Lieutenant Commanders Robert B. Brown, Jesse T. Nicholson and Harold E. Stedman, (MC) U. S. N. R. (2). A few comments are recorded here to give the chief points of interest and the major conclusions.

The plan followed in wound treatment was a conservative one. Most of the patients reached the ship after primary treatment had been given elsewhere. This had usually consisted in sprinkling the wound with one of the sulfonamides and the application of a dressing.

It was apparent from the first that intensive debridement or wound excision was unnecessary and inadvisable at the time the patients were received. A thorough mechanical cleansing of the surrounding area and of the wound itself, with generous use of water and saline solution, was followed by the removal of loose tissue and foreign bodies with scissors and forceps. An effort was made to avoid any bleeding. Sulfathiazole microcrystalline powder or suspension was introduced into the wound and vaselin-gauze was placed in deep wounds. Pressure dressings, combined with immobilizing splints or casts, completed the treatment.

All wounds of soft tissues were treated according to this plan, whether they were large open wounds, puncture wounds, or wounds with compound fractures. No attempt was made to close any wound by suture, except wounds of the face and mouth. In wounds crusted or filled with caked sulfonamide, no particular effort was made to remove the drug, and experience showed that little if any harm was done by the presence of the drug in an open wound. Sulfonamides (sulfathiazole usually) were given by mouth only when cellulitis around the wound with fever indicated a spreading infection.

Foreign bodies were removed when they were easily accessible in the wound, when they caused pressure or infection, or when they were so superficially located as to be removable through a shallow incision.

Contrary to opinions expressed in the literature, it was found that spinal and local anesthesia could be used to advantage in operative procedures for battle injuries. In the 7 months beginning with August 1942, 726 patients were taken to the operating room for treatment. Of these, 210 were treated without any anesthesia except an injection of morphine. Many of these were wounds or fractures of the upper extremity for which casts or splints were applied. Of the remaining 516 operative procedures, all but 57 were on patients with battle injuries. In this group the kinds of anesthesia used and the number of patients in which each was applied were as follows: Spinal anesthesia, 224 (of which 9 were supplemented with nitrous oxide or pentothal sodium); local anesthesia, 220; brachial plexus block, 8; intravenous pentothal sodium, 51; and gas or ether by inhalation, 13. It will be seen that 443 (almost 86 percent) of 516 operative procedures were carried out entirely under some form of local anesthesia.

There were 2 operative deaths, both in patients with gas gangrene, one operated upon under spinal anesthesia, the other under nitrous oxide and oxygen.

Gas gangrene became an increasing problem in our experience with battle casualties. Of 11 deaths from battle wounds, 6 were the result of this infection. In approximately the first 4,000 patients evacuated from the battle area there were 7 deaths, of which only one was due

to gas gangrene, and there were also 2 patients with this infection who survived. Among the next 3,300 patients evacuated there were 8 deaths, 5 due to gas bacillus infection, and in addition there were 5 patients with this infection who survived. It is important to note that all the cases of gas bacillus infection arose from action ashore and none from naval battles. Three of the deaths occurred in patients whose wounds had been closed by suture before they arrived on board the *Solace*. In the patients who survived, conservative treatment was employed: Free incision, generous use of sulfathiazole locally and by mouth, and large doses of antitoxin intramuscularly. The preference of the intramuscular over the intravenous route for giving the antitoxin should be stressed, both because of the greater likelihood of severe reactions and the faster elimination of the antibodies by way of the kidneys when the antitoxin was given intravenously.

There were few patients with abdominal wounds who reached the *Solace*, probably because so many of such wounds are rapidly fatal. They had all received primary treatment elsewhere. Two of the battle-casualty deaths were patients who came to the ship 3 and 9 days respectively after they had suffered abdominal wounds in naval action. In both of these patients there was widespread peritonitis that prohibited operation.

About 100 cases of chest wounds were seen, only 1 of which proved fatal. The details of the findings in, and the treatment of, these patients have been reported by Commander L. Kraeer Ferguson and Lieutenant Commander Robert B. Brown, (MC) U. S. N. R. (3). The keynote of their management was conservatism. Tapping was performed in hemothorax and hemopneumothorax only for respiratory embarrassment or for diagnosis when infection was suspected.

No cases of tetanus have been seen on the ship since her commissioning; an eloquent testimonial to the effectiveness of prophylactic immunization of all service personnel and the use of the booster dose of tetanus toxoid after an injury or a burn.

Included in the 4,069 surgical cases handled during the evacuation duties of the ship are the patients seen on the orthopedic service. The largest group was composed of the fracture cases, 775, of which 476 were compound and 299 simple. The number of individual fractures was even greater, since many patients had suffered two or more broken bones. A detailed report on the treatment of the compound fractures was prepared by the orthopedic surgeon, Lieutenant Commander Jesse T. Nicholson, (MC) U. S. N. R., the general surgeons, Commander L. Kraeer Ferguson and Lieutenant Commander Robert B. Brown (MC) U. S. N. R., and the roentgenologist, Lieutenant Ellwood W. Godfrey (MC) U. S. N. R., (7).

For that article, Lieutenant Commander Nicholson submitted an analysis of a series of 558 patients with 599 fractures, 432 of which were compound. There were 342 fractures of the leg, 171 of the arm, and 83 of the pelvis, spine, scapula, ribs, and skull. There were 108 fractures of the femur, 85 of them involving the shaft, and 76 of these in turn were compound. In one evacuation 22 femur fractures were handled. Many of the fractures had been reduced and immobilized before the patients came to this ship, but 325 reductions were performed on board. Of these 129 required spinal anesthesia, 10 general anesthesia, and 186 were accomplished with local or no anesthesia.

A majority of the compound fractures were from 3 to 10 days old upon admission. The splints were of a temporary nature: Thomas splints for femur and humerus, and plaster of paris, wire, or board for the lower leg, forearm, hand, and foot. It was not infrequent to find the patients still clothed in the remnants of their combat uniforms.

Patients with compound fractures were given one-fourth grain of morphine an hour before the time for anesthesia. For lower extremity fractures, procaine crystals, 120 to 150 mgm. in solution, were given intraspinally. For other fractures 5-percent pentothal sodium solution was given intravenously, or brachial block was induced with 2-percent procaine solution. Some lower arm fractures were reduced without anesthesia. After the induction of anesthesia, the splints were removed, and the skin surfaces cleansed with green soap, ether, or gasoline. If skeletal traction was to be applied, the area of the skin was painted with merthiolate, and the pin or wire introduced. After irrigation of the wound with saline solution all foreign particles were meticulously picked out. No bone fragments were removed unless they were free in the wound without attachment to muscle or periosteum. Abscess pockets, if present, were opened through communicating fascial planes, so as not to start fresh bleeding. The wounds were then dressed in the manner described in an earlier paragraph. Gauze dressings were piled to conform with the wound outline, so that the wound sites could be identified through the plaster of paris and a window made over the wound if a dressing was believed necessary. Reduction of the fracture was made, with the help of the portable fluoroscope, on a fracture table whose top is translucent for x-rays. It is noteworthy how well even extensively comminuted fractures could be aligned with only slight traction. In only one instance, a simple transverse fracture of the leg, was reduction not obtained on a day when at sea the use of the fluoroscope was forbidden.

Open reductions were done in only 14 of the 424 reductions carried out by both the orthopedic and the surgical services, 4 times in simple, and 10 in compound fractures.

Certain modifications in fracture treatment were necessary under the conditions at sea. Balanced traction could not be used, due to the roll of the ship. All fractures had to be immobilized as quickly as possible, because the vibration of the ship caused pain at the fracture site. All fractures had to be fixed so that patients could be moved in case it were necessary to abandon ship. This called for adaptations of dressings so as to get patients into stretchers and through narrow passageways. Double hip-spicas could not have an abduction of the legs greater than that permitted by a bunk 28 inches wide.

The plaster of paris casts were applied next to the skin. Felt was used under the cast only over bony prominences and at the margins of the cast. Potassium alum was used in the water in which the plaster bandages were soaked to speed the setting of the plaster.

Sulfathiazole was given by mouth for a week after injury to all patients with compound fractures. If the drug had been discontinued before reduction of the fracture, it was again started. The dosage was 1 gram every 4 hours for 2 days, then every 6 hours for 2 days, and every 8 hours thereafter.

Procaine hydrochloride, injected in 2-percent solution at the fracture site, was used with good results in fractures of transverse processes of the lumbar vertebrae, ribs, impacted radial heads, single metatarsal bones, shaft of the fibula, and malleoli without displacement. The injection, followed by gentle active motion, was practiced on 2 successive days and again 3 days later. Patients with fracture of lumbar transverse processes returned to duty in an average of 3 weeks, the others, in a somewhat shorter time. Injection of 1-percent procaine hydrochloride was often helpful in the treatment of sprained knees and backs.

Included among the surgical patients evacuated were 163 urological cases. The largest single group was that of 38 patients with proved or probable renal calculus. A total of 66 such cases has been admitted since the commissioning of the ship. They were practically all young men in their twenties, a few even in the late teens. Inadequate fluid intake, free perspiration and a resultant high urinary concentration in a hot climate probably constitute the chief cause of stone formation in these patients, although dietary factors may also be active. Gonorrhea and its complications accounted for 30 cases, and chronic prostatitis, presumably nonvenereal, was the diagnosis in 22 instances. There were 11 cases of pyelitis and pyelonephritis, 10 of syphilis, 6 each of wounds of the genitalia, enuresis and hematuria, and 5 each of varicocele and hydrocele.

During the evacuation period there were admitted 262 patients to the *Eye, Ear, Nose, and Throat Service*. But a great many more patients had lesions of these organs in addition to the major cause

for their admission to the sick list. Thus, 16.8 percent of those admitted because of war injuries had injuries of the eyes as well. Conversely, 78 percent of those admitted to the eye service because of eye wounds also had wounds elsewhere in the body. Between 14 August 1942 and 1 March 1943 (not quite the whole of the evacuation period of our activity), there were 451 combat casualties involving the eyes. The direct causes of the lesions included: Burns 212, shrapnel 87, blast 36, unidentified debris 31, gunshot 24, aerial bomb 16, hand grenade 12, the rest scattered. They resulted in injuries of the globe sufficiently destructive to require evisceration or enucleation in 23 patients. In addition there were 136 patients with intraocular or intra-orbital foreign bodies in one or both eyes. Approximately 80 percent of these were removed while the patients were on board. Sixty percent of the foreign bodies were magnetic. The details of the ocular lesions were reported in a article by Capt. Harry P. Schenck and Lts. Louis E. Silcox and Ellwood W. Godfrey (MC) U. S. N. R. (11). They also published their observations on the retinal response to fluoroscopy as a diagnostic aid (12).

Injury to the internal ear was the only important otolaryngological lesion that was encountered due to battle and service conditions. The chief causes were the explosions of gunfire and prolonged exposure to noises, such as those of airplane motors. Captain Schenck and Lieutenant Silcox wrote their observations on a series of patients with traumatic deafness (13).

During the lulls between actions there were performed in this department numerous operations of election, such as tonsillectomy, submucous resection, and plastic surgical procedures. It also deserves emphasizing the value of the out-patient service of this section to units afloat and ashore. The diagnosis and treatment of such cases at times assumed major proportions. Thus, nearly 1,300 out-patients have been seen in a single month. Refractions and consultations bulked equally large in this work.

The nature and number of our cases assured the *X-ray Department* of a large amount of diversified material. From the time of commissioning to 30 June 1943, there occurred a total of 5,475 x-ray examinations and treatments. Of these, 5,275 were made on 4,293 patients on and after 7 December 1941. Of these, in turn, 4,975 are analysed in table 2.

The roentgenologist was especially favored by the nature of his work to observe the effect of battle injuries and has collaborated with the various medical officers in putting much valuable material on record in the several articles already referred to. Commodore Richard A. Kern and Lieutenant Ellwood W. Godfrey (MC) U. S. N. R. have also reported some observations on pneumohydropericardium (4).

TABLE 2.—Analysis of 4,975 x-ray examinations made on board the U. S. S. Solace

Chest	936	Wrist	150
Spine	448	Femur	135
Sinuses	423	Abdomen	133
Gastro-intestinal tract	371	Pelvis	119
(Swallowing function)	7	Shoulder girdle	117
(Barium-meal study)	258	Elbow	105
(Barium enema)	51	Forearm	102
(Cholecystogram)	55	Orbit	102
Knee	271	Humerus	68
Foot	233	Mastoid	42
Urographic study	231	Mandible	40
(Retrograde)	66	Clavicle	29
(Intravenous)	165	Os calcis	28
Lower leg	214	Nose	22
Hand	210	Temporo-mandibular joint	17
Skull	206	Scapula	16
Ankle	204		

Among the roentgenological impressions gained from battle casualties are the following: Sea battles produced multiple and bizarre fractures of the extremities, due to the patients being thrown by an explosion beneath the deck or in an adjacent compartment. In the order of frequency there were observed fractures of the os calcis and astragalus, dislocations of the knee, and compression fractures of the upper lumbar and lower dorsal vertebrae. Three patients suffered a fractured pelvis while they were lying on the deck at the time of the explosions. Fragments of shrapnel seen in patients wounded in naval actions were generally larger than those from land actions.

Most of the wounds incurred in land actions were due to rifle bullets. When such a missile struck a bone the resultant fracture was highly comminuted. Yet in spite of marked loss of substance, there was little alteration of alignment or shortening of the part. This was particularly evident in compound comminuted fractures of the femoral shaft, and would seem to show that displacement in fractures generally is due to the force causing the fracture, rather than the muscular pull.

After rifle bullets, the most common causes for wounds ashore were fragments of bombs and hand grenades. So-called personnel bombs and hand grenades on exploding were shattered into innumerable tiny fragments. Patients so wounded were found on x-ray examination to have multiple small foreign bodies, most frequently beneath the exposed surfaces of the body, including the eyes.

The most unusual case first recognized on this ship was in a man wounded at Pearl Harbor by a 25-caliber machine-gun bullet which entered the back, a little to the left of the midline, and came to rest in the myocardium within half an inch of the anterior surface of the heart in the region of the interventricular septum. The nature of the injury was not recognized at the time of occurrence, since the patient had almost no symptoms, was not hospitalized, and returned to duty in a few days. The bullet was only discovered days later when a chest film was made after the patient complained of undue dyspnea on slight exertion. The bullet was later successfully removed by

Captain E. F. Holman (MC), U. S. N. R., at the U. S. Naval Hospital, Mare Island, California.

A second unusual case was that of a Marine struck in the cheek by a 25-caliber rifle bullet. For a time no point of exit was found, but on the side opposite the point of entry the tonsil was missing and the ear drum was shattered. The films showed a streak of metal dust extending through the maxillary sinus, across the palate, and out of the opposite ear.

Of great value in studying the patients were any films that had been made previously. These were collected from the activities transferring the patients to this ship and were passed on in due time to the receiving facility, together with the films that were made on board.

The work in the X-ray Department was carried out in bursts of activity, at times right through the night, especially when patients were being received, in anticipation of early sailing, or right after the ship was at anchor. This was because of the poor definition of films taken at sea, due to the vibration, augmented at times by the roll and pitch of the ship. At times, also, the use of the x-ray at sea was forbidden.



COMPARATIVE FOOD VALUE OF THREE TYPES OF WHEAT FLOUR

Diet experiments on a human subject are reported. White bread while readily digested is deficient in minerals and vitamins. Whole-wheat bread is unsuitable for a steady diet because of its large content of indigestible matter. Bread made from flour representing 85-6 percent extraction of the wheat is quite satisfactory and is to be preferred.—GUILLEMET, R., JACQUOT, R., TRÉMOLIÈRES, J., and ERFMANN, R.: Comparative food value for man of three types of wheat flour; rational solution of the problem of bread for France. Bull. soc. chim. biol. 27: 56-64, 1945; Chem. Abstr. 40: 3163, June 10, 1946.

CHARCOT-LIKE JOINTS IN YAWS

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The American physician on first encountering the clinical entity known as yaws, or frambesia, is confused by the similarity of the disease to syphilis. The impression is obtained that he is viewing the cutaneous manifestations of a syphilis whose illustrations filled the older textbooks, but which is not frequently seen today. In a continued conscientious attempt to set up criteria for differential diagnosis, his confusion increases, and it is small consolation carefully to peruse the literature and find the age old controversy still raging (22) (24) (25). Bacteriologically, the most modern methods available will not aid his diagnosis (1) (2). Morphologically the causative organisms of yaws, *Treponema pertenue*, and of syphilis, *Treponema pallidum*, are indistinguishable, despite the generally held belief that differences exist. It is further contended by authorities such as Stitt, Zinsser and Bayne-Jones that neither spirochete has ever successfully been cultivated on media.

After observing many cases, the clinical differences become more apparent (1). The original lesion in yaws is almost invariably extragenital it is found most frequently in children and is a large, crusted-over, fungoid mass, reddish in color, and remotely resembling a flattened strawberry. The secondary eruption is composed of lesions exactly similar to the primary. But the lesions are often plebian, and rarely a Hunterian-like genital chancre may occur, and a secondary rash closely resembling that of syphilis (5). The skin lesions in yaws may keep reappearing in crops for three to five years, and infected lacerations and abrasions may develop yaw-like characteristics. In the field of late manifestations of yaws, and the comparison with their syphilitic equivalents, great differences of opinion exist (23). A statistical poll of the authors writing on this subject leads to the conclusion that late visceral changes in yaws are uncommon, and central-nervous system involvement resembling tabes dorsalis and general paralysis is extremely rare, if occurring at all. An interesting side-light on the question of acquired immunity is the legend that early American negro slaves brought from Africa to this country, previously infected with yaws, encouraged the development of widespread cutaneous lesions, lest the disease be "driven in," to

appear in more serious form late in life. The natives of the central Pacific islands today are of a similar opinion, and put their theory to practice by inoculating children whose lesions are ill-defined or scanty with material scraped from the yaws of their better-erupted playmates.

Despite previously-held concepts, the white man is not immune (14) and since the disease has been shown by Turner (24) to be capable of transmission by a fly, the *Hippelates pallipes*, it is possible that cases may occur in troops stationed in endemic areas (6). As our experience increases with this disease it is inevitable that peculiar clinical aspects (16) (19) will be brought to our attention, and perhaps force us to reconsiderations of generally accepted pathological explanations of other diseases.

Already gangosa, or rhinopharyngitis mutilans, formerly considered a leprous manifestation, is now held to be a late sequel of yaws, or at least of spirochetel origin. Likewise, goundou, an entity characterized by the development of horn-like exostoses on the nasal and frontal bones, is at present considered of yaws origin. But of all the late complications of yaws, it is the changes in bone that provide the field for greatest speculation. Bizarre pictures occur frequently, especially in the untreated cases.

Goldmann and Smith (9) roentgenologically have investigated the yaws lesions of bone. Within four weeks of the onset of symptoms small oblong areas of translucency appear in the substantia compacta of the long bones, often giving it a moth-eaten appearance. There are symptoms at this time of local pain and pyrexia. Without treatment the lesions pass into an inactive stage, where the bone responds by cortical proliferation encroaching upon the medulla, while the density is diminished in streaky lines obliterating the demarcation between the substantia compacta and medulla. This is the picture commonly seen, and it may remain unchanged for years. Occasionally it slowly progresses to a "marble bone" stage, in which the bone is massive but brittle. When fractures occur, usually from slight trauma, healing is poor, and callus formation faulty unless therapy is given. As a rule, the process becomes quiescent of its own accord, although occasionally, due to loss of cortical density in children, the bone will tend to bend in the healing stage.

Trauma may cause a flare-up at any time and activate old minimal lesions. The changes in the spinal column are thus characterized by erosions, spurs, and bony bridges, oftentimes closely resembling those of hypertrophic arthritis. It is noteworthy that in at least two circumstances symptoms and roentgen appearance do not appear compatible. In the spinal column due to the trauma of walking, lifting, etc., old foci will become reactivated. If x-rays are taken at this time,

eburnation or localized osteitis will be found, yet the patient will complain little, if at all (9). Likewise, in growing children the joints and epiphyses may be widely involved with considerable osseous destruction and yet with few subjective complaints (6) (9) (25). This is a characteristic of yaws that has not been stressed in the literature. It would appear that sensitivity is diminished in chronic osseous yaws. The extent to which this relative absence of pain may progress brings up the interesting possibility of victims of yaws actively using involved joints without acute subjective appreciation of the damage occurring; a situation exactly comparable to that found in the Charcot joint of syphilis. Stated differently, the loss of joint pain-sense peripherally in yaws theoretically could produce a pathological picture comparable to that caused by the cord changes in syphilis.

While observing native stevedore battalions at work in the Marshall Islands, the writer was impressed by the clumsiness of the gait in several of the older men. They stood on a wide base, and occasionally swayed to one side while walking, not unlike the ataxia of tabes dorsalis. All of them had been infected with yaws in childhood or adolescence. On physical examination, tendon reflexes were entirely normal and there was no evidence of cutaneous analgesia or hypesthesia. They were well developed, well nourished, and showed no evidence of any deficiency disease. Their bodies described alarming arcs when attempting the Romberg test, but all could compensate sufficiently to prevent their falling. They complained of no lancinating neuralgic pains, paresthesias, or bladder disturbances. There were no complete or incomplete Argyll-Robertson pupils, ocular palsies, or hypotonias. The blood Wassermann was positive in three and negative in one of four so tested. One, with positive blood serology, had a spinal puncture, and his fluid showed no increase in lymphocytes and a negative colloidal gold curve and Wassermann. The skin of the knee, leg, ankle, and foot in this patient was sensitive to light touch, temperature, and pin prick. It was possible to investigate his joint sensibility directly during the course of aspiration of a concurrent prepatellar bursitis. The skin about the knee joint was anesthetized with procain, and a fine (26-gauge) long needle was inserted into the joint. There was practically no sensation to insertion of the needle through the articular cartilage into the bone, although the opposing fascia and subcutaneous tissue and skin were normally sensitive. X-ray findings of this joint were essentially normal. It was thus ascertained that the knee joint of this individual, infected with late yaws, was relatively insensitive to pain, yet without showing any other sign of bone or nerve disease. If this were true, it should logically follow that all conditions previously hypothecated for the development of the arthropathy known as Charcot joint were present, and that there

should develop, due to local interruption of pain fibers, a clinical picture comparable to that cause by spinal interruption of these fibers (7).

The purpose of this paper is to present a case in which the bone lesions of late yaws are indistinguishable from the tabetic arthropathy known as Charcot joint; and to add yaws to syphilis and syringomyelia (4) in the diagnostic consideration of joints of this type.

In *tabes dorsalis*, 1.75 to 10 percent of the cases develop trophic lesions, and among these the osteo-arthropathy of Charcot (3) is the most common. The onset may be insidious or follow a small, chip fracture of the end of the bone which, because of the deep anesthesia, goes unnoticed. The abnormal position of the joints as in *genu recurvatum* may produce an internal derangement that subsequently causes pronounced disintegration of the cartilaginous surfaces (17). It is held also that neurogenic disturbances to the ends of the bone and to the synovia make them prone to fragility and to wear away (3) (7) (11). Proliferative changes also occur, as in *arthritis deformans*, with hyperplasia of cartilage and of the ends of the bones composing the joint, usually irregularly and chiefly at the edges of the articular surface (18).

Effusion invariably follows, and the periarticular tissues become thickened and firmly edematous. Large distended veins, which *Brisaud* has compared to the abdomen of a dropsical child, cover the surface of the skin. As the condition progresses the entire end of the bone may become destroyed and the shaft of the diaphysis project into the joint. The proliferated spurs of bone may fracture and become osteophytes, or whole segments of bone such as the femoral condyle, tibial malleolus, or portions of the distal tibia become dissociated.

Fractures occur repeatedly, and in some cases the affected joint feels like a bag of marbles. Bizarre dislocations take place and the continued trauma to the painless joint grinds away interfering osseous tissue, producing a flail-like sequela. Roentgenological diagnosis is not difficult. The irregular osteophytic development, areas of patchy osteoporosis, widening of Haversian canals, and frequent egg-shell appearance, in addition to destructive joint findings, characterize the process (18). The knee is most frequently affected, although the ankle, hip, wrist, ribs, and feet are involved less frequently. In the case of arthropathies of the tarsal and metatarsal bones, a characteristic form of flat-foot develops, the *pied tabétique*. The disease is rare in the spinal column, most often affecting the lumbar region, and extremely rare in the fingers. Multiple involvement of joints is not particularly uncommon.

It has been held, and was first set forth by Charcot in 1868 (3) that the joints peculiar to late syphilis and that now bear his name, are the result of *tabes dorsalis*. It was hypothesized that the cells of the

anterior horn of the spinal cord exert a "trophic" influence upon the skeleton and the skin, and that they are in turn stimulated reflexly by neurons entering by way of the posterior roots (3) (11). It was also held that the trophic lesions of tabes are brought on in part by disturbances of blood flow to the part, the result of interruption of the centrifugal fibers of the autonomic nervous system, whose calls arise in the lateral horns of the spinal column. Hans Iselin (11) in his classical work on tabetic arthropathies held that not all forms of so-called tabetic arthropathy are purely tabetic in origin. He felt that Charcot joints may be the expression of true periosteal osseous syphilis. Or, that a non-specific inflammatory process had complicated an already existent tabetic joint, as has been demonstrated in the bacteriological studies of Seimens-Cohen and Delbet-Cartier (Bing). This theory has been subjected to widespread criticism.

It has been demonstrated by Eloesser (7) that joints in the cat indistinguishable from tabetic joints may be developed experimentally by the section of sensory nerves and trauma. He also showed that the discomfort occasionally incident to Charcot joints is a result of trauma to tissue outside of the field of joint anesthesia because the joint surfaces, periosteum, and bone are quite insensitive to needle prick or scratches (8). Joints identical with those of late syphilis are found in syringomyelia, an observation first noted by Schultze and Kohler in 1888 (quoted in Hodges, Phemister, and Brunschwig (18)). It has also been demonstrated in humans that section of the sciatic nerve may result in joints of this type (13). There are few clinical conditions yet encountered where localized, peripheral joint anesthesia occurs. It is of particular interest that a spirochetal infection, so closely allied to syphilis, is responsible for the case here presented. The situation presented appears to be in accord with the reasoning of Charcot, Eloesser, Phemister and others that joint anesthesia, whether the influence of "trophic" nerves is considered or not, alone is responsible for the development of the neurogenic arthropathy, that bears the title of "Charcot joint." One cannot dispute the possible existence of a low-grade spirochetal infection of the joint itself as considered in tabes by Herndon (10), McCallum (15), and Stargardt (21), but to date this has not been proved.

CASE REPORT

A native Marshallese, age 51, was first seen at a naval advanced base dispensary in the Marshall Islands complaining of pain in the left knee of a year's duration, and inability to walk of 4 month's duration.

His past history revealed a peritonsillar abscess at age 7 years, and yaws from ages 12 to 15. His eruption was poor, and crusts from his brother's lesion were transferred to his own scarified skin to encourage the development of a better

eruption. He recalls that his bones ached during this period but never of sufficient intensity to require treatment or to force him to go to bed. Most of the aching occurred in the tibiae. He had influenza in 1919, to which he nearly succumbed. He has two healthy children ages 20 and 24, and has had several more who have died of accidents or infections. Questioning revealed no history of any hereditary stigmata in any of his offspring. He denied having had gonorrhea or a chancre, and the Japanese-educated doctor, who has known the patient for many years, stated that syphilis was unknown on the atoll where he lived. His joint symptoms apparently began about three years ago, but the complaints were minimal and caused only transient discomfort. Four months ago the pain and swelling became very severe in the left knee, and, after attempting to continue walking on the joint, the present deformity occurred which has prevented further ambulation. He had no complaint other than that referable to his left knee, and laughed off the involvement in the other joints by demonstrating their painlessness.

Physical examination revealed a pleasant, well-preserved, native man of 51. The skin was of normal color and showed only a few healed scars on the lower legs and right arm. The pupils were equal and reacted to light and accommodation. Arteriosclerotic changes were present in the retinal vessels to a marked degree. The ears were normal and hearing acute. The teeth were carious, several missing, and many roots were still present. The lung fields were clear,



FIGURE 1.—Arthritic-like changes in fingers and deformities of ankle and knee joints.

the heart sounds of normal quality, without murmurs. The radial arteries were hard and tortuous, the BP 140/82. The abdomen was soft, liver and spleen not palpable. Genitalia were normal, and no penile scar was found. Rectal examination was negative. A complete neurological examination was done. There were no demonstrable abnormalities in any of the cranial nerves. Superficial and deep reflexes, including the patellar reflex in the badly swollen left knee, were active and equal throughout. No abnormal reflexes were elicited. Skin sensation was unimpaired to pin-prick, light touch, heat, and cold. There were no hypesthesias. Crude attempts to test for vibratory sense revealed no impairment. Heavy bone pressure was painful. There was an indication of total loss of joint sense in the knees and the left ankle, but this was not present in the other joints so tested.



FIGURE 2.—Showing swelling and dislocation of left knee.

The hands were bilaterally deformed with enlarged metacarpophalangeal articulations and with extension limited to a right angle. Shoulders, elbows and wrists appeared normal. The spine was stiff, and most of the flexion occurred in the mid-thoracic and cervical region. The hips moved freely without pain. The left knee was greatly swollen and dislocated laterally. The left ankle was shortened, twisted medially, and could be extended until the dorsum formed a straight line continuous with that of the anterior tibia. The right knee was moderately swollen, hypermobile in all directions, and painless. There was a grating sensation on all movements and the crepitus resembled that of a fresh fracture. The right ankle was slightly swollen, exhibited grating on motion and a loose piece of bone could be palpated posteriorly. The tibial arteries were sclerotic but the circulation to the feet was excellent and normal dorsal pedal pulsations were felt.

The left knee joint had been aspirated previously with the removal of 250 cc. of sanguinous fluid. At the time of the second aspiration a long needle was used, first for aspiration, and then inserted in all directions into the femur and tibia. It was found that the removal of the fluid provided great relief of his pain, an observation in accord with that of Eloesser (8) in cases of Charcot joint. As in the case of the man previously tested, there was an absence of all pain in the remnants of cartilage and the bone ends of the femur and tibia. The exploring needle could be inserted into the diaphysis without any indication of pain. The skin, fascia, and joint capsule were normally sensitive. An area of skin proximal

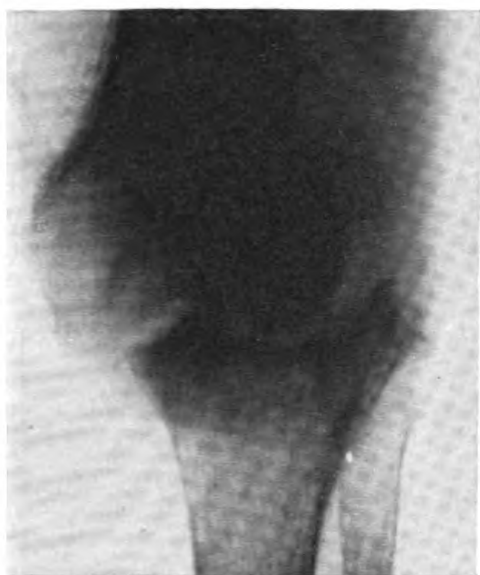


FIGURE 3A



FIGURE 3B

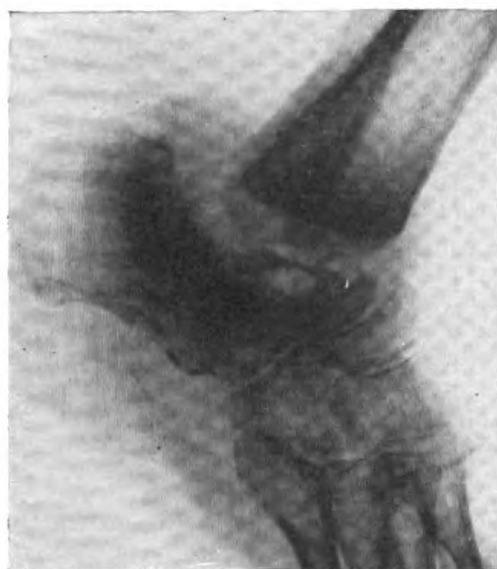


FIGURE 3C



FIGURE 3D

FIGURE 3.—(A) Left knee. Showing the extensive changes of dislocation, erosive destruction of articular cartilages, periosteal proliferation, osseous proliferations and loose bodies. The x-ray appearance of a joint such as this is considered by many, in the cases of luetic arthropathies, to represent a far-advanced type of degenerative arthritis, in which the absence of pain is responsible for the massive destruction that takes place. (B) Right knee. Approximation of diaphyses through eroded cartilages and bone. A movable, painless joint. (C) Left ankle. Massive bone destruction involving articular surfaces and distal ends of the tibia and fibula and major portion of the talus. (D) Right ankle. Anterior dislocation with marked narrowing of articular space, loose fragments adjacent to joint, marginal osteophytes and lipping. Note blood vessel calcification.

to the joint on the lateral aspect of the thigh was injected with procaine solution and it was found on inserting the needle that the bone outside the joint space responded normally to painful stimuli. The right knee and both ankles were similarly tested with exactly comparable results.

Laboratory examination revealed a blood hemoglobin of 85 percent, with 4,200,000 erythrocytes and 9,900 leukocytes, of which 75 percent were polymorphs, 23 percent lymphocytes, and 2 percent eosinophiles. The blood Wassermann and Kahn were positive. The urinalysis was normal. The spinal fluid was under normal pressure, clear, with 0 to 1 cells per HPF and negative for globulin, the colloidal gold curve was 0-0-0-0-0-0; and the Wassermann and Kahn were negative.

Microscopic examination of the joint fluid removed at the time of the first aspiration showed only erythrocytes, but the second aspiration revealed 50 to 60 leukocytes and organisms identified as staphylococcus aureus. No spirochetes were demonstrated on either occasion by dark-field examination.

Treatment consisted of instilling penicillin solution, 250 units per cc., into the left knee joint on two occasions, and administering 300,000 units intramuscularly. Aspirations of the joint 3 months later revealed fluid purportedly straw colored with no gross evidence of pus. He had had a course of 10 injections of mapharsen without noticeable improvement.

COMMENT

As in any instance of differential diagnosis involving yaws and syphilis, absolute elimination of the latter disease is difficult, oftentimes impossible. In the absence of other signs of tabes dorsalis, a highly selective spinal cord lesion would have to be assumed in order to explain the physical findings. Repeated observations of the patient whose case report is presented for almost a year failed to reveal any sign of nervous involvement; final proof lies only in pathological examination of the spinal cord. The mass of evidence, in an individual known to have yaws, does not favor a diagnosis of osteo-periosteal syphilis. To those believing in the synonymity of yaws and syphilis this case is presented as an interesting manifestation of spirochetal infection.

No explanation can be given at this time for the localized joint anesthesia associated with these lesions. One would expect, from the findings on the other subject tested, that the anesthesia precedes the destructive process, in which case Charcot-like joints result from simple failure of peripheral sensibility. It cannot be disproved, however, on the basis of the case that, as Iselin claimed in syphilitic arthropathies, these joints may not represent true osteo-periosteal yaws. The similarity between these lesions and those of degenerative arthritis is striking, especially in the spinal column (fig. 4). In view of the findings in this case and the questionable etiology of degenerative arthritis, a wildly-speculative question might be raised as to whether the primary lesion in degenerative arthritis might not consist of a diminution in joint-sensibility.

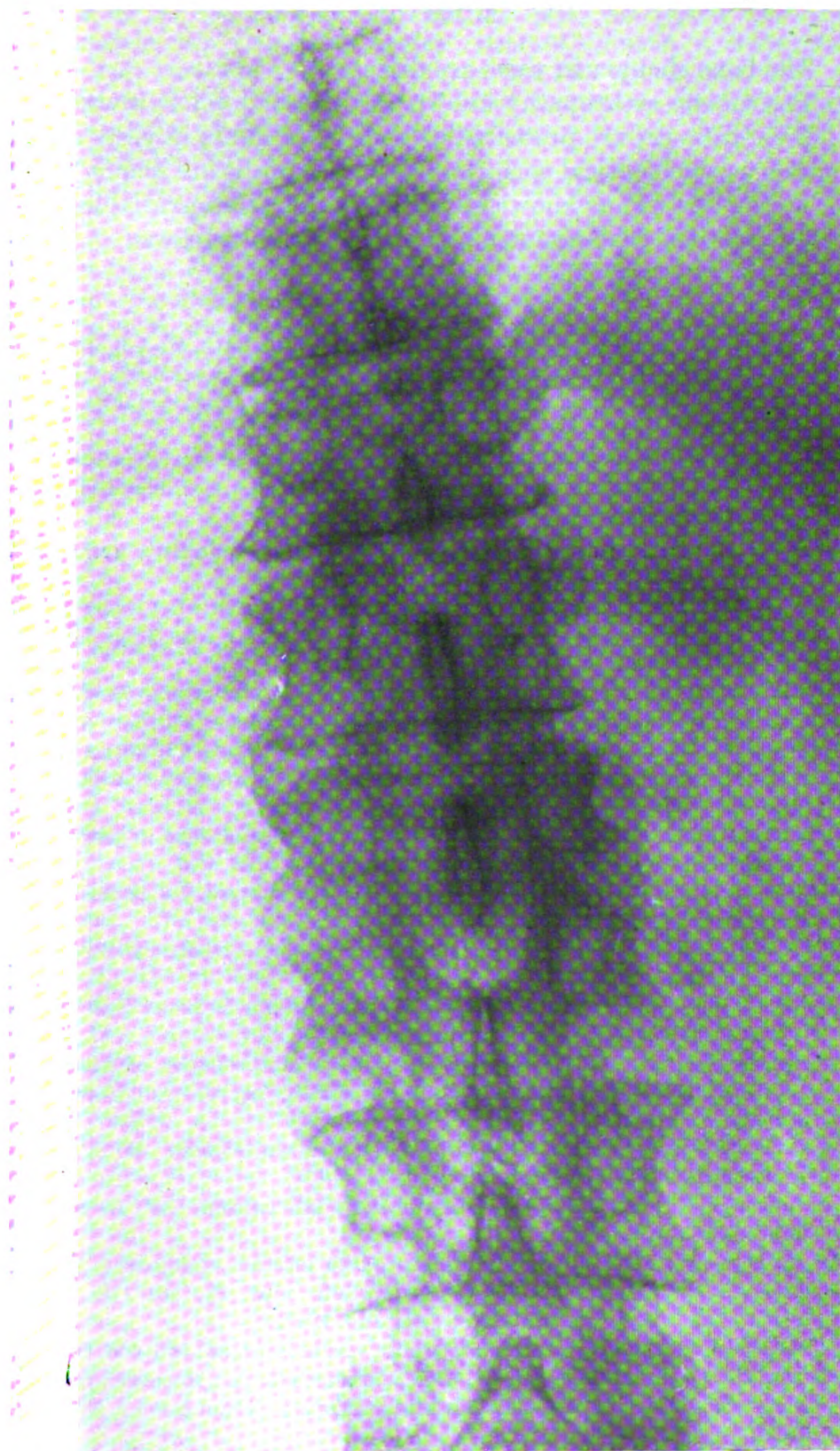


FIGURE 4.—Dorso-lumbar spine. Extensive marginal osteophytes and fusion.

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SUMMARY

1. The bone changes in yaws are discussed.
2. The tabetic arthropathy known as Charcot joint is reviewed.
3. Two instances are presented of anesthetic joints in yaws and deformities in one identical with those of late syphilis are demonstrated.
4. To the best of our knowledge, with the literature available, this is the first reported instance of Charcot-like joints in yaws.

REFERENCES

1. BUTLER, C. S.: Septic syphilodermata. *Am. J. Clin. Path.* 9: 1-9, Jan. 1939.
2. BRICENO ROSSI, A. L.: El valor del verifications test, en la serologia del carate o mal del pinto y buba (plan o yaw). *Rev. san. y asist. social* 8: 153-165, Feb. 1943.
3. CHARCOT, J. M.: Sur quelques arthropathies qui paraissent dependre d'une lésion du cerveau ou de moelle épinière. *Arch. de Physiol. norm. et path.*, 1: 161-168, 1868.
4. CLAESSEN, G.: Radiography in demonstration of syringomyelitic arthropathy. *Acta. radiol.* 6: 296-302, 1926.
5. VARGAS CUELLAR, P. I.: El plan en el departamento del Valle del Cauca, Colombia. *Bol. Ofic. san. panam.* 20: 897-913, Sept. 1941. *Abs. Trop. Dis. Bull.* 39: 38, Jan. 1942.
6. de WYTT, W. H. H. J.: Diagnosis and treatment of yaws among West African troops. *J. Roy. Army M. Corps* 81: 255-262, Dec. 1943.
7. ELOESSER, L.: Neuropathic affections of joints. *Ann. Surg.* 66: 201, Aug. 1917.
8. ELOESSER, L.: Sign occurring in cases of tabes complicated by Charcot joints. *J. A. M. A.* 77: 604, Aug. 20, 1921.
9. GOLDMANN, C. H., and SMITH, S. J.: X-ray appearance of bone in yaws. *Brit. J. Radiol.* 16: 234-238, Aug. 1943.
10. HERNDON, R. F.: Three cases of tabetic Charcot's spine. *J. Bone & Joint Surg.* 9: 605-612, Oct. 1927.
11. ISELIN, H.: Zur Genese der Arthropathia tabica. *Deutsche Ztscher. f. Chir.* 227: 414-439, 1930.
12. JELLIFFE, S. E. and WHITE, W. A.: *Diseases of the Nervous System*. 6th edition. Lea and Febiger, Philadelphia, 1935.
13. KERNWEIN, G. and LYON, W. F.: Neuropathic arthropathy of ankle joint resulting from complete severance of sciatic nerve. *Ann. Surg.* 115: 267-279, Feb. 1942.
14. KINELL, J.: Yaws; report of case appearing in white man. *U. S. Nav. M. Bull.* 42: 187-192, Jan. 1944.
15. MCCALLUM, W. O.: *Textbook of Pathology*, 4th edition. W. B. Saunders Co., Philadelphia, 1928.
16. MONACELLI, M. and PISANI, D.: Pseudosclerosi laterale amiotrofica familiare associata a nodosità juxta-articolare. *Sett. med.* 28: 161-178, Feb. 16, 1940. *Abs. Trop. Dis. Bull.* 38: 57-58, Jan. 1941.
17. POTTS, W. J.: Pathology of Charcot joints. *Ann. Surg.* 86: 596-606, Oct. 1927.
18. HODGES, P. C., PHEMISTER, D. B., and BRUNSCHWIG, A.: *Roentgen-ray Diagnosis of Diseases of Bones and Joints*. Thomas Nelson & Sons, New York, 1938.

19. PRONK, K. J.: De buigcontractur aan den pink, een typisch laattertlair symptoom van framboesia tropica. *Geneesk. tijdschr. v. Nederl.-Indië* 81: 1403-1407, July 1, 1941. *Abs. Trop. Dis. Bull.*, 39: 41, Jan., 1942.
20. SHANDS, A. B., Jr.: Neuropathies of bones and joints; report of case of arthropathy of ankle due to peripheral nerve lesions. *Arch. Surg.* 20: 614-636, Apr. 1930.
21. STARGARDT, K.: Ueber die Aethiologie der tabischen Arthropathien. *Arch. f. Psychiat.* 49: 936-954, 1912.
22. STITT, E. R.: *Yaws*. Oxford Loose-leaf Medicine.
23. STITT's *Diagnosis, Prevention and Treatment of Tropical Diseases*, 6th edition. The Blakiston Co., Philadelphia, 1942.
24. TURNER, T. B.: Studies on the relationship between yaws and syphilis. *Am. J. Hyg.* 25: 477-506, May 1937.
25. WILLIAMS, H. U.: Pathology of yaws, especially relation of yaws to syphilis. *Arch. Path.* 20: 596-630, Oct. 1935.



A PORTABLE INSTRUMENT FOR RECORDING HUMAN RESPIRATION

A novel apparatus for recording respiration in human beings has been devised by Mr. Ralph Poole, 50 Bedford Square, W. C. 1. It comprises an ordinary breathing-mask or face-piece attached by flexible tubing to an air-flow meter. The air-flow meter consists of a light spring-controlled vane working in a suitably shaped chamber. Attached to the vane spindle and moving with it is the secondary coil of a small transformer the fixed primary coil of which is fed by A. C. at 12 volts, obtained by stepdown from the mains. The secondary coil is connected to a recording voltmeter and the induced voltage is proportional to the deflexion of the vane. The air-flow meter is strapped to the subject, and trailing leads connect it to the A. C. supply and the recorder, which may be any distance away. The advantages of this instrument are the negligible resistance offered to breathing and that recording may proceed while the subject is performing any type of work. Unfortunately, its usefulness is limited by the fact that it records only the velocity of tidal movements and not the absolute tidal volumes.—Research Items: A portable instrument for recording human respiration. *Nature* 157: 701, May 25, 1946.

GUILLOTINE AMPUTATION MODIFIED TO PRESERVE SKIN FLAPS

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It is frequently reported from those who have had to do with the postoperative care of patients subjected to guillotine amputations, that great difficulty is encountered by the surgeon and severe pain is experienced by the patient in the attempts to obtain and secure adequate skin around the stump. It is therefore considered pertinent to redescribe the following modification of the guillotine operation and to emphasize its usefulness in military surgery. This technique is speedy and not difficult; it maintains the over-all Army and Navy policy of leaving the wound open; it preserves and secures adequate skin flaps; and in most cases obviates subsequent revision of the stump. This opinion is based on personal experience with no less than 50 amputations performed upon patients with arteriosclerosis or diabetes in civilian life. The method was satisfactorily used for two mid-thigh amputations during evacuation of Army casualties by this ship (APA) in a recent invasion.

In the case of a mid-thigh amputation the pubes, genitalia, and thigh are shaved and prepared in the usual manner. The leg is draped in such a way as to leave the member to be amputated free for manipulation and removal from the table during the operation. No tourniquet is used.

The surgeon stands on the same side as the leg to be removed. An assistant steadies the leg and holds the flexed knee medial to its normal position, thereby partially rotating the femur inwardly. With his left hand the operator grasps the bulk of the quadriceps muscles, pinching them as far anterior to the femur as possible. With his right hand he inserts the point of a 7½-inch Liston amputating knife (sharp edge directed distally) into the lateral aspect of the thigh at the level where the bone is to be amputated. The knife is directed toward the femur and when the bone is contacted the point of the knife is slipped anterior to it and finally through the muscles and skin of the medial aspect of the thigh. Maintaining contact with the femur, the knife is made to cut distally for one or 2 inches, whereafter the incision is directed both anteriorly and distally until all the tissues anterior to the femur are severed (fig. 1). A Kocher

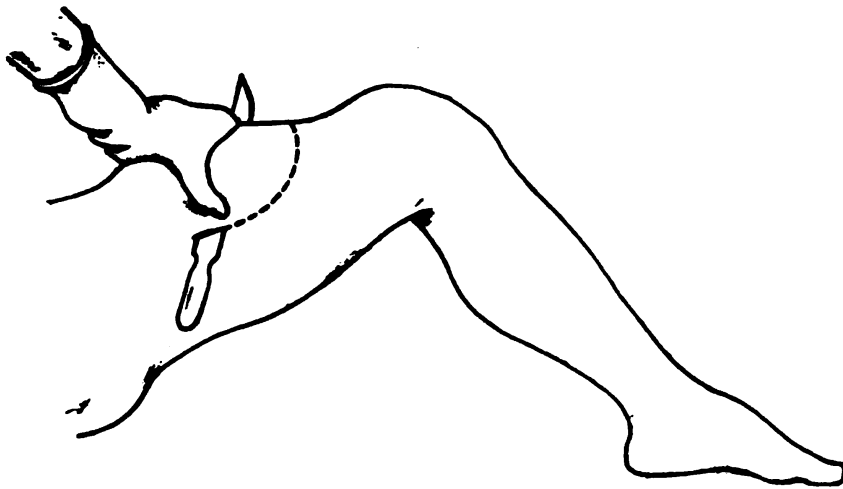


FIGURE 1.—The knife is directed anterior and perpendicular to the femur.

clamp is then placed on the deep fascia of the flap to retract it upwards and bleeding is controlled with small clamps. If the thigh has been inwardly rotated, the femoral artery and vein will escape this incision.

The knife is then inserted posterior to the femur and anterior to all remaining soft tissue (fig. 2.). The downward stroke of the knife is then similar to the incision previously described, except that before the blade is carried posteriorly, the assistant across the table compresses the great vessels between the thumb and fingers of his left hand in case of the right thigh or his right hand if the left leg is being removed. He must be sure that his entire hand is proximal to the blade. The incision takes but a few seconds, and immediately thereafter the sur-

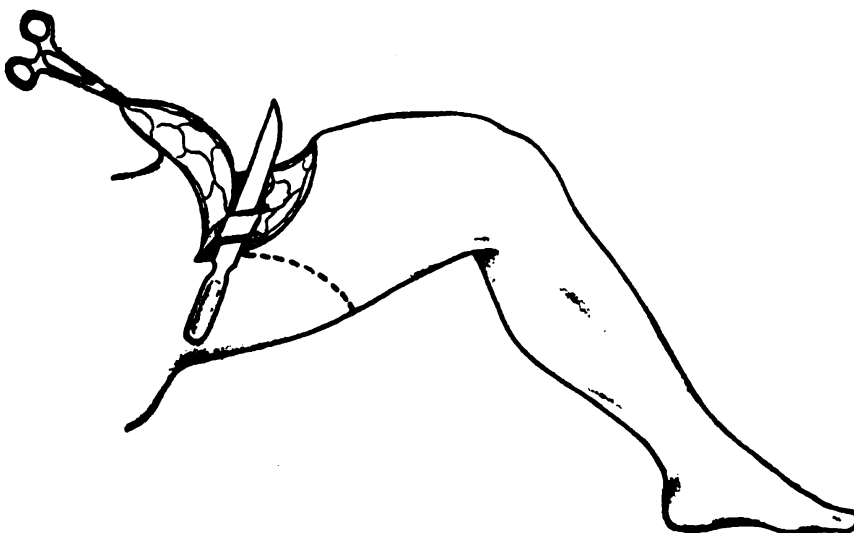


FIGURE 2.—The knife is placed posterior to the femur and made to cut distally and posteriorly.

geon clamps the femoral artery and vein, allowing the assistant to release his grasp. After all bleeders have been clamped, any remaining muscle fibers are quickly cut away from the bone and the femur is amputated with a straight saw at the apex of the incisions. During the sawing the proximal portion of the femur is steadied and the soft tissues protected from the saw by a loop of rolled wet toweling passed around the shaft of the bone.

All bleeders are now ligated with cotton or silk. Sulfathiazole impregnated vaselin-gauze strips are placed over the entire raw surface, and the "fish mouth" created by the incisions is copiously packed with sterile dry gauze. This pack is held in place by five or six heavy sutures, which pass through the skin and deep fascia of the edges of the flaps (fig. 3.). They remain distal to all the packing. It is important that these sutures are pulled tight enough to secure the pack firmly and prevent retraction of the flaps without blanching the skin. The sutures are not tied but twisted together, wrapped in a small gauze sponge to prevent their maceration, and clamped with a strong Kocher clamp. A sterile roller bandage is applied to the stump as an added dressing.

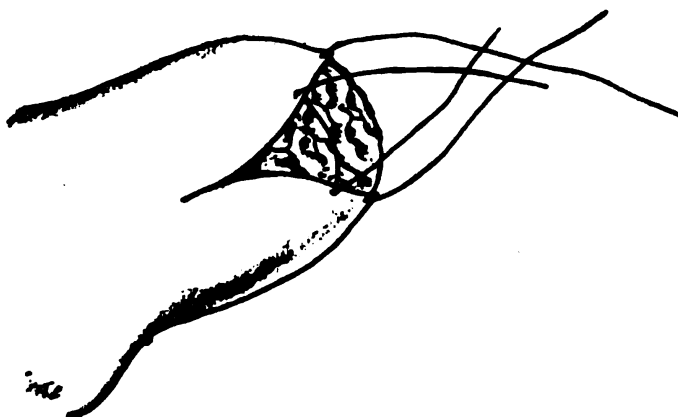


FIGURE 2.—The through and through sutures hold the flaps over the gauze pack.

The questions of type of anesthesia, injection of the sciatic nerve with alcohol, premedication, smoothing of bone edges, removal of bone marrow, type of sutures, and postoperative use of sulfonamides or penicillin may be determined by the individual surgeon according to his inclinations or the exigencies of each particular case.

Postoperatively the clinical course is watched closely for indications of infection, and the stump treated accordingly. Usually there will be none, in which case the dressing remains untouched for four days, when under light pentothal sodium anesthesia, and using sterile technique, the sutures are loosened by removing the clamp, and the pack removed. If there is a clean granulating wound the sutures already in place are used to approximate the edges of the flaps, thereby con-

verting the stump into a closed wound after the danger period is past. (In civilian practice the clean cases were closed during the primary procedure.)

If the postoperative clinical course or appearance of the wound indicates the presence of sepsis, the stump is then treated as an infected wound until such time when it can be safely closed.

Although this operation¹ is most applicable for amputations at the thigh, it may be modified and advantageously used for the arm, forearm or fingers.

ACKNOWLEDGMENT.—The author acknowledges the assistance of David L. Buckley, Signalman, third class, U. S. N. R., in preparing the sketches reproduced as figures 1, 2, and 3.

¹ The operative procedure described is reproduced by memory from the teaching of Dr. Robert Forrest Barber, Professor of Clinical Surgery, Long Island College of Medicine, and Chief of Surgery, Long Island College Division, Kings County Hospital, Brooklyn, N. Y.



TREATMENT OF CASE OF AEROBACTER BACILLURIA

Authors' summary.—1. A case of long-standing urinary tract infection due to *Aerobacter aerogenes* is presented.

2. The organism was resistant, *in vivo*, to penicillin, sulfathiazole, and common urinary antiseptics, but sensitive, *in vitro*, to 0.3 micrograms of streptomycin per cubic centimeter.

3. A prompt bacteriological cure was effected by the parenteral administration of 6.8 grams of streptomycin sulfate, given over a 72-hour period. Substantial blood levels were attained.

4. Apart from the local discomfort of intramuscular injection, there was no serious or uncontrollable toxic effect from the use of streptomycin in this case.—BLACKSTONE, B. B. G., SOMMERNESS, M. D., and SCOTT, E. G.: Treatment of obstinate case of *Aerobacter bacilluria* with streptomycin. Delaware State M. J. 18: 101-104, May 1946.

HOW SHALL WE EVACUATE THE CASUALTIES?

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The transition in the Pacific from war on small coral atolls to war on comparatively large land masses, has necessitated revision of our methods of casualty evacuation. Prior to the Philippines and Okinawa campaigns this problem was relatively simple. The casualties were evacuated a few yards, or at most a few miles, and removed to the APA's, APH's, AH's, or LSTH's for definitive care. On the large islands where we have recently operated, and where we will conduct our future attacks, it has been, and will be, necessary to move patients for 25 or 30 miles to hospitals ashore for definitive care. To an inhabitant of the United States removing an injured person such a distance in a well-cushioned ambulance, over smooth, concrete highways, at high speed, and with the right of way, poses only a minor problem. To the medical officer with the Marines on a Japanese island where the road is at best tortuous, bumpy, dusty, shell-pocked, crowded by trucks and tanks, studded with detours around blown-out bridges, where ambulances crawl and lurch jerkily along at five miles per hour, or where sections of the road are entirely impassable, the problem is a major one.

As in so many medical problems, no panacea presents. Under certain circumstances one means of casualty evacuation will be most effective. Under other conditions another method may be more desirable. Our interest is in the acceptance of the concept that several parallel and alternate means of patient movement must be provided, each to be utilized when it is most advantageous. These must be provided for during the planning phase of an operation so that they will not have to be improvised on the target.

In recent operations, in order to overcome the divers difficulties encountered in evacuating wounded, the following means of evacuation were resorted to:

¹ Received for publication 3 October 1945.

- (A) Land
 - (1) Manual carrying of litters
 - (2) Ambulances
 - (3) Armored vehicles
- (B) Water
 - (4) Boats
 - (5) Amphibian tractors and Duwks
 - (6) LSTH's
- (C) Air
 - (7) Airplanes
 - (8) Helicopters—suggested

Each of these methods has its place in any comprehensive scheme of casualty movement.

(A) Land

(1) *Manual carrying of litters* will obviously be necessary when vehicles are not available, and where vehicles cannot go.

(2) *Ambulances*.—Road transportation will remain the mainstay of our evacuation system so long as roads are available. There are presently three types of ambulances in use. The majority are jeeps. Field ambulances are used in lesser numbers. Where patients must be moved for several miles over the primitive, dust-choked roads, which will be a feature of future operations, the jeep is a miserable carrier. Its lack of springs and protection for wounded from dust and rain are decidedly unbeneficial. Excessive jolting of hemorrhaging and shocked patients is patently prejudicial to their survival. The malignancy of the penetrating, lung-searing dust, generated by the passage of thousands of trucks and tanks over inferior roads, is unbelievable unless experienced. With the expected progression of the war from the Tropics into colder climates the wounded will require protection from cold and rain. The field ambulance provides an infinitely more comfortable means of progress. It is smoother riding. It is closed and heated. It carries four stretchers, as against two in the jeep. It can go practically anywhere the jeep will go.

Large-scale operations on large islands produce large numbers of casualties. It is the responsibility of each echelon in the evacuation chain to remove wounded personnel from the next forward unit to itself. The Battalion Aid Station brings the injured from the companies, the Medical Company from the Battalion Aid Station, the Division Hospital from the Medical Companies. Efficient evacuation from the Division Hospital to the Corps Hospitals, by Corps, can best be accomplished through an ambulance pool. Vehicles from the several facilities must operate under a central agency if efficient collection of casualties and equitable apportioning of them among the hospitals is to be maintained. The Corps Medical Battalion is the logical agent.

(3) *Armored vehicles* are used to extricate wounded from areas where unprotected personnel and ambulances cannot go. The tracked

vehicles may also be employed when mud renders roads otherwise impassable. These, however, are very rough riding, therefore shocking, and should be used only in emergencies.

(B) Water transportation

(4) *Boats*.—There are times when roads are so badly cut to pieces by the passage of many trucks and tractors that rain and mud combine to make them impassable. There are times when blown-out bridges necessitate long, time-consuming detours over tortuous, bumpy roads. There are times when clouds of thick, clinging, choking dust billow up with every passing vehicle, to settle in a pasty, yellow cloak over every nearby object. There are times when roads are under enemy sniper and mortar fire. There are times when rain, fog, and snow keep aircraft grounded. During such periods water transportation for short distances is of the greatest value. Boats will frequently carry patients comfortably on rivers, across harbors and inlets, or along the coast when the trip by road is either entirely impossible or long and tiring, or when dusty, wet, or cold. A safe, short, smooth, warm boat trip in such circumstances brings the patient to the hospital in infinitely better condition.

(5) *Amphibious vehicles* may be used in lieu of boats.

(6) *LSTH's* are now used as casualty carriers in all amphibious operations, but commonly only for inter-island transportation. On large islands they are equally valuable for short distance patient movement. They present the following advantages: (a) When roads are unsafe or impassable, and the distance to the hospital is more than a few miles, transportation via LSTH assures the patient a more comfortable and less shocking journey. He is rested by it rather than exhausted; (b) Patients can receive needed care and operative therapy aboard ship while en route; and (c) Patients may be transferred directly to an AH for evacuation from the area.

On the other hand there are certain very definite disadvantages in this mode of transportation: (a) The LSTH can make, ordinarily, a single daily trip. If it carries more than a few seriously injured men the surgeon aboard will not have time to perform the necessary surgery on all of them. This means that a number of cases will be denied definitive care for some hours. If the patient has lain disabled in a fox hole overnight, is removed to the ship late in the morning, is not one of the more seriously injured, and is placed aboard a crowded AH in the evening, his surgery may be delayed as long as 36 hours; (b) There is invariably considerable difficulty in persuading the LSTH to maneuver to the patient's best advantage. This is due, not to any lack of cooperation or desire on the part of any one, but rather to the complex system of communication and command. We have seen

patients subjected to an hour-long boat ride to reach an LSTH anchored far from shore, when it could have come up to the reef edge in perfect safety, simply because the captain had been ordered to anchor in a specified spot.

(c) An LSTH is not always available when it is most needed. Approximately three days are required to transmit the necessary orders through the various commands before the ship is released for hospital duties. In at least one instance on Okinawa the need for the LSTH had passed before it was made available.

Such experiences teach us that provisions for assigning LSTHs to coastwise evacuation must be made prior to the operation if their services are to be obtained when most needed.

(C) Air

(7) *Airplanes*.—Air evacuation depends on control of the air. It has long been used to transport the injured over great distances. It is just as useful in removing the wounded from Aid Stations or Medical Companies to hospitals. When roads are bad, when surf on the reef precludes the use of boats, the air ambulance will deliver the patient quickly, comfortably, and safely to the vicinity of the hospital. We have used Sentinel (OY) planes, carrying a single stretcher, operated by artillery spotting personnel, for air evacuation over distances as short as 10 miles. Flying at only a few hundred feet, head and chest cases did well. The patients arrived in excellent condition, and were given the benefit of surgery much earlier than they could have received it by any other means of travel to the hospital. There is no doubt that this resulted in saving the lives of some of the more severely injured. The morale of the men who came to the hospital via air was noticeably better than that of other patients. They not only realized that they were the recipients of prompt and efficient care, but they got a "kick" from the short air journey.

It is our belief that the advantages of short-distance evacuations by the Sentinels over ambulance trips under even the most favorable road conditions, are so many and so obvious that this means of patient movement should be provided for in the future. The thousand-yard Cub landing strips can be prepared by a bulldozer in a few hours. A flat area of this length is not difficult to find. The coral ground of these islands provides good landing areas for the light planes without working over. The preparation of a landing strip for the Sentinels adjacent to each of the larger hospitals would not be a very arduous undertaking. Prior to the construction of landing strips we have used sections of road for loading patients.

(8) *Helicopters*.—This is a type of airborne evacuation which has been successfully used elsewhere. These machines need no landing

strips. They could land nearer the patient in many instances when picking him up, and could deposit him on the hospital grounds.

If this type of air evacuation can be arranged for in future operations a secondary salubrious result will ensue. Frequent moves of Corps hospitals will be obviated. While we pride ourselves on the mobility of the hospital facilities attached to the Marines, it remains a fact that every move detracts from the ability of the hospital to care for patients. Change of location cannot be accomplished without taking down the facility, with consequent temporary loss of bed capacity. There is also the attendant loss of man-work-hours while the hospital is in the process of "rolling up," transported, and rebuilt. The hospitals would also be able to function just as effectively a few miles farther behind the lines. This would render them less exposed to enemy shell fire, and to infiltration of the enemy behind our lines. The latter has been a constant source of annoyance.

It might be well to state here that we are not enthusiasts for all air evacuation. Long air trips enable the wounded to quickly reach distant hospitals. They are spectacular. They provide excellent publicity material. But long air journeys are not necessarily beneficial to the patient. Patients do not get the rest, the attention, or the nourishment which ship-transported patients receive. Having worked in a Fleet Hospital receiving casualties from the Saipan, Guam, Peleliu, and Philippines operations, we know that by and large the casualties who came by ship were in much better condition. Our feeling in this regard has been corroborated in conversations with surgeons from many other Fleet and Base Hospitals in the Pacific.

CONCLUSIONS

Efficient casualty evacuation from the front to hospitals in the rear demands the establishment of several alternate routes of patient movement. If these be provided for in advance, and each be utilized to its best advantage, the wounded will benefit thereby.

ABNORMAL VASCULAR SPASMS—AN ADDITIONAL ETIOLOGIC AND THERAPEUTIC CONCEPT

Preliminary Report

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Commander (MC) U. S. N. R.

Marked and frequent fluctuations in manometer readings are observed in some cases of hypertension. This is especially true in the menopausal syndrome. Both systolic and diastolic pressures are involved although the former varies much more than the latter. The same fluctuations may be seen in some male patients with hypertension, mostly in the age group 35–55. It can be assumed that the fluctuations in blood pressure are due to vascular constrictions or spasms. Spasms may be either local or general. They are general when hypertension is present, or local, for instance, when the coronary arteries constrict causing anginal pain. They may be combined as in cases of coronary spasm with hypertension. If the constriction of a blood vessel is prolonged it leads to ischemia not only of the tissues supplied, but also of the blood vessel itself. This ischemia results in a weakening of the end-arteries and when relaxation finally occurs the restored pressure of the blood results in disruption of the vessel with hemorrhage.

It is generally accepted that the immediate cause of normal menstruation is a constriction of the spiral arteries. When conception fails to take place after ovulation, the corpus luteum regresses resulting in a decrease in estrogenic and corpus luteum hormones. There is a corresponding increase in prolactin. The spiral arteries constrict with increasing intensity and duration until the ischemia results in damage to the structures of the endometrium finally ending in necrosis, bleeding, and desquamation. The spiral arteries are included in this disruption.

The same hormonal changes that precede menstruation are also present in the menopause. One of us (W. A. S.) has given much consideration to the theory that a large group of abnormal vascular spasms occurring in the age group 35 to 55 has a common predisposing factor,

namely, a decrease in gonadal hormones and an increase in pituitary hormone (prolan). Some of the conditions encompassed by this theory are: Spasmodic hypertension resulting in cerebral hemorrhage, angina pectoris leading to coronary thrombosis and hemorrhage, and the menopausal syndrome.

In order to evaluate this theory six patients were given small doses of x-rays (100 "R" units) to the pituitary, and gonadal hormones, di-ovocynin in females and perandren (testosterone propionate) in males. Two of the patients were previously hospitalized for coronary disease and showed EKG evidence of permanent cardiac damage. One had anginal attacks but gave no history of disability resulting therefrom. There were three cases with menopausal syndromes. Treatment in each case was confined to an area measuring 4 by 4 cm. centered over the pituitary. A total of 175 "R" units was delivered on each side, and the pituitary gland should have received approximately the dose specified. The following factors were used: 220KVP, 50 cm. FSD, 15 MA, using $\frac{1}{4}$ mm. of copper plus 1 mm. of aluminum as a filter.

To eliminate psychological factors in estimating blood pressure each patient was repeatedly examined over a period of at least three weeks before treatment was instituted. The pressures recorded are a mean of at least three readings.

CASE REPORTS

Case 1.—The patient, age 53, was hospitalized and treated for coronary heart disease, arteriosclerotic, from April 7, 1943 to June 1, 1943. On admission his blood pressure was 190/100 which decreased to 140/90 on discharge. EKG revealed coronary heart disease. On April 10, 1945 he was again admitted for the same condition. This time the attack was milder and he was able to resume work after 10 days. Blood pressure on discharge was 150/100. On June 25, 1945 and June 28, 1945 he was treated with 100 "R" units to the pituitary. Perandren 25 mg. "H" was administered every 3 days for 3 doses beginning the same day he received the x-ray treatment. Within two weeks following this treatment the blood pressure decreased to 122/82, the pain over his heart and shoulder disappeared and he was no longer "heart conscious". His capacity for physical effort was increased. Freedom from symptoms lasted until August 7, 1945 when there was a recurrence of pain over the heart radiating to the left clavicle, which was brought on by a sudden increase in work. He was again admitted. All symptoms disappeared after 3 days without treatment. The patient remained well until September 18, 1945 when he was discharged from the service. Blood pressure at that time was 122/78 as compared with 146/96 before treatment.

Case 2.—The patient, age 50, had an attack of coronary thrombosis on November 3, 1943. Blood pressure at that time was 165/95. EKG showed permanent T wave changes. On July 16, 1945 EKG was suggestive of healed myocardial infarction. Blood pressure 144/80. One hundred "R" units were administered to the pituitary on July 16, 1945 and on July 17, 1945. Perandren 25 mg. was administered every 3 days for 3 doses. Although the patient had no definite symptoms at the time of treatment, he stated in general he felt much better. His blood pressure on release from service on August 9, 1945 was 124/78.

Case 3.—This female patient, age 44, had bilateral oophorectomy and hysterectomy on June 3, 1944. Severe menopausal symptoms present. Pain over heart and left shoulder, blood pressure 162/100. EKG showed sinus arrhythmia and left axis deviation. There was no history of disability due to coronary disease although the patient stated that she had been refused insurance. On June 26, 1945 and June 27, 1945, 100 "R" units to the pituitary and di-ovocylin 5 mg. were given. The patient was free from all symptoms until August 21, 1945 when the "hot flashes" recurred, although very mild at first and needing no treatment until September 6, 1945. The blood pressure was reduced to 104/68. Until October 15, 1945 her only symptoms were hot flashes which were easily controlled with di-ovocylin 5 mg. every 3 weeks.

Case 4.—This female patient, age 42, had a hysterectomy in October 1944. Fibroids found. Symptoms: Headaches daily for 3 years. Puffiness of eyelids (upper and lower) since operation. Painful buckshot-like lumps in breasts. "Hot flashes" since March 1945. On July 9, 1945 and on July 10, 1945, 100 "R" units were administered to the pituitary. Di-ovocylin 5 mg. given on July 9, 1945. All symptoms were relieved until August 24, 1945 when hot flashes and pains in the breasts recurred although in much milder form. The blood pressure was reduced from 170/100 to 128/86. At present the symptoms are controlled with di-ovocylin 5 mg. every 3 to 4 weeks.

Case 5.—This female patient, age 33, had bilateral oophorectomy and hysterectomy in July 1944. Symptoms: Tired, hot flashes, and nervousness. Blood pressure 120/80. On July 10, 1945, 100 "R" units to the pituitary were administered. Di-ovocylin 5 mg. given. All symptoms disappeared until August 17, 1945 when patient was last seen. At that time the hot flashes were returning but were only present once a day and lasted only one minute. The blood pressure was reduced to 104/60 and she felt "very good."

Case 6.—This female patient was aged 46. Symptoms: Palpitation of the heart on and off for past year. Hot flashes two or three times a day for past 2 years. Menstrual history: Began at age 12, occurred every 28 days, and lasted 7 days. Amenorrhea for 8 months and 3 months in past year. Blood pressure 144/80. Patient was taking stilbestrol for past few months. On July 9, 1945 and on July 10, 1945, 100 "R" units to the pituitary and 5 mg. di-ovocylin were administered. In this patient the marked reduction in blood pressure from 144/80 to 114/76 lasted only 5 days when it returned to the approximate former level 140/86. However, the fluctuations were decreased and there were no more hot flashes until August 27, 1945 when the patient was last seen.

DISCUSSION

The relief from abnormal spasmodic vascular constrictions with 100 "R" units to the pituitary and the administration of 5 mg. di-ovocylin (in a single dose by intramuscular injection) in females and 3 injections of 25 mg. perandren in males lasted on the average for about 6 weeks. It is known that gonadal hormones alone will produce this effect because of suppression of the function of the anterior pituitary but the duration of relief from symptoms is much shorter, about 3 weeks with 5 mg. di-ovocylin instead of 6 weeks when 100 "R" units were added. The effect of perandren is shorter. X-rays to the pituitary are a known treatment for hypertension, but the results obtained are supposed to be derived from its effect on the posterior lobe.

In coronary cases after elimination of the etiological factors of mental stress, physical effort, allergies, and arteriosclerosis, another important cause or predisposing factor must be considered, i. e. decrease in gonadal hormones and increase in prolactin. It is of significance that in cases Nos. 1 and 2 neither patient had sexual intercourse for several years and had no desire for any. Case No. 5 began treatment with a blood pressure of 120/80. This was reduced to 104/60. She felt much better with this lower blood pressure and it may be assumed that this was normal for her. The reduction in blood pressure in all cases was accompanied with a marked decrease in the fluctuations of both systolic and diastolic pressures.

CONCLUSION

One of the causes or predisposing factors of arterial spasms both local and general is a decrease in gonadal hormones and an increase in pituitary hormone (prolactin).



CHEMICAL TEST FOR PRESENCE OF CANCER

Treatment of cancer with butyrate or its halogen derivs. is reported to cause an increased excretion of amino acids, which fact may be utilized as a chemical method for the diagnosis of cancer.—WATSON, J.: Chemical test for the presence of cancer; its early detection and destruction by the selective action of bromo and chlorobutyrate. *Med. Press & Circ.* 215: 128-129, 1946; *Chem. Abstr.* 40: 3180, June 10, 1946.

INDUSTRIAL DENTISTRY AT NEW YORK NAVAL SHIPYARD

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The field of industrial dentistry is a relatively new one, but has attracted widespread interest in the last few years and has received recognition and clarification by The American Dental Association (1). The field assigned to the industrial dentist is generally recognized to include dental examination work (including x-ray service), palliative emergency measures to relieve acute conditions, control and care of occupational dental diseases and injuries, and dental health education. Dental prophylaxis is sometimes included as an examination procedure, and orientation of the patient among treatment facilities is sometimes included as a health educational measure. Planning and performance of all "permanent" dental treatment such as fillings, crowns, dentures, and usually extractions are not included, except following an industrial injury. The object of industrial dental service as thus defined is to reduce absenteeism from dental causes and to improve the efficiency and good will of the employee.

In 1943 a study was made to determine the extent of dental absenteeism among the 65,000 civilian employees of the New York Naval Shipyard. Claims for sick leave for periods of more than 1 day were the only source of data easily available. The study revealed the following facts:

1. Of 1,200 applications analyzed, 23, or roughly 2 percent, were for dental disabilities.
2. The 23 dental applications covered a total of 38.4 days lost time, or 1.7 days per application.
3. At that period, 515 sick-leave applications of all types were being received per day on the average from the entire yard personnel. Each application was for an absence of more than 1 day.
4. Two percent of 515 times 1.7 gives approximately 17 man-days lost per day for dental reasons in absences of over 1 day. With a 9 hour working day, this represents 153 man-hours.

The inadequacies of this study are obvious. Absences of one day or part of a day were not tabulated, though these were known to exist. The report of the applicant was the only source of information, since time and facilities did not permit a medical or dental examination.

Inefficiency on the job due to subacute dental conditions remained unmeasured as did also the systematic sequelae of dental infection. Nevertheless a volume of dental need was definitely found, sufficient in itself to justify the attention of one dental officer. Since a dental officer was already in constant attendance in the main medical dispensary (Building 122) to assist in the preparation of NAVMED Form Y and his time was less than half occupied, it was felt that an attempt at industrial dentistry might logically be made by this officer as soon as an office could be found and equipped for him. The main dental clinic was located outside the yard at too great a distance from civilian medical facilities to make any other solution of the problem practical.

Cordial interest in the project was displayed by the yard and district dental officers and the yard medical officer. In late 1944 a suitable dental office became available in the Labor Board Medical Office, Building 200, across the street from the main dispensary. A dental chair, unit, cabinet, x-ray machine, and instruments and accessories for diagnosis and emergency treatment were installed in this office. The dental officer assigned there was to perform dental examinations for the Marine Guard Company, for all personnel requiring NAVMED Form Y, and for medical-dental cases referred by the dispensary. In addition it became possible for him to treat emergency conditions of various sorts, such as gingivitis and Vincent's infection arising among the Marines. These duties, however, still permitted much time for attention to civilian personnel.

The civilian dental service was announced as of 27 October 1944 by a Commandant's notice worded as follows:

UNITED STATES NAVY YARD
NEW YORK, NEW YORK

27 October 1944

COMMANDANT'S NOTICE

From: Commandant.

To: Heads of Departments, Divisions and Offices, Masters of Shops.

Subj.: Emergency Dental Treatment for Civilian Employees.

1. Emergency dental treatment for the relief of pain is now available to civilian Yard workers at the Dental Clinic (Labor Board, Building No. 200, Sands Street Gate) between the hours of 0900 and 1600 daily, except Sunday. No extractions or permanent restorations of any sort will be performed.
2. The object of the service will be to give treatment of a first aid nature only in order to relieve acute dental conditions until regular appointments can be made by employees with their own dentists.
3. In view of the fact that these facilities will be somewhat limited at the start, this notice is being published for information and guidance of

addressees and their principal assistants. Posting of this notice on the bulletin boards is not desired until the facilities for dental treatment are augmented, based on a study of the future needs for the service.

4. Form 107, which is now in use for referring employees to the Dispensary, in medical cases, shall be used for this purpose.

MONROE KELLY

The note of caution in this announcement is obvious and represents an understandable fear that an avalanche of patients would immediately demand attention. Such was not the case, however. The civilian patient load reached 4 per day soon after the publication of the notice and remained at that level month after month. Since the average case takes no more than 10 minutes to treat, it is obvious that this load was far below the capacity of the office. Additional publicity was therefore requested for the dental office early in 1945, but the yard authorities did not feel this to be advisable at the time.

The type of emergency treatment rendered to civilian yard workers needs fairly careful description. Zinc oxide and eugenol, of course, was the drug combination most frequently used. Abscesses were occasionally lanced, but more often were drained through the pulp canals by means of pulp-canal cleaners and reamers. X-rays were taken for diagnosis of acute conditions. Acute gingival conditions were given preliminary treatment. In every instance the effort was made not only to confine treatment to relief of pain but to avoid any instrumentation or advice which would take from the hands of the private dentist the decision as to what type of "permanent" treatment to render. Examinations were confined within the strict meaning of the term "examination" and were neither diagnoses nor treatment plans. No forceps, or amalgam or silicate instruments were allowed in the instrument cabinet. Form NAVEXOS 107 was completed in each instance, as for a dispensary medical case. Figure 1 shows the face of this form with typical notes by the dental officer.

More than 9 out of 10 dental emergencies were non-occupational. The few occupational or "industrial" cases which were found were the results of more or less unpredictable injuries as from falls or blows with heavy tools. The yard is responsible under Federal compensation laws for a full follow-through on such cases. Diagnosis and any possible palliative measures were undertaken in building 200, but extractions, bridgework, and the like were referred to the Marine Hospital, Staten Island.

Cordial cooperation has existed with the medical officers and hospital corpsmen and with the civilian nurses in the yard. The nurses particularly, since they remained in their own dispensaries without constant transfer, developed a personal interest in their patients and good discrimination as to the type of case deserving of dental attention.

DISPENSARY PERMIT - CASE NO. _____

SICK OR INJURED EMPLOYEE RETAIN THIS ORIGINAL COPY UNTIL TREATMENT IS TERMINATED, THEN GIVE TO SUPERVISOR

FROM: SUPERVISOR _____

TO: MEDICAL OFFICER, 200

(BLOG., NAME OR NO.)

DATE	TIME LEFT JOB	TIME RETURNED
<u>8/8/45</u>	<u>0930</u>	

THE BEARER OF THIS PERMIT IS EXCUSED FROM HIS WORK FOR THE MINIMUM TIME NECESSARY FOR TREATMENT AT DISPENSARY INDICATED.

BEARER'S NAME	BADGE NO.	RATING
<u>Johnson E.</u>	<u>112345</u>	

RETURN TO SUPERVISOR (NAME)	SHOP
<u>Smith W.</u>	<u>X51</u>

M. O. REPORT	TIME REPORTED	TIME RELEASED
	<u>0945</u>	<u>0955</u>

☒ ☐ **OCCUPATIONAL** ☒ **NON-OCCUPATIONAL**

☒ **1. RETURN TO WORK** ☐ **2. SENT HOME**

☐ **3. TRANSFERRED TO** _____ **HOSPITAL**

☐ **4. OTHER DISPOSITION** _____

☐ **5. TO RETURN FOR FURTHER TREATMENT.** zinc oxide and eugenol

☐ **6. PATIENT WILL PRESENT A CERTIFICATE OF ILLNESS FROM HIS PHYSICIAN AND REPORT TO DISPENSARY BEFORE GOING TO WORK.**

DIAGNOSIS 2727

SIGNED D. J. Surgeon **M. C., U. S. N.**

NAVEXOS - 107 REV. 1-44 ☐

FIGURE 1.—Form NAVEXOS 107 with typical notes by supervisor and dental officer up to time patient leaves dental office.

How much time has been saved for yard workers by these measures? A true estimate is almost impossible to make, but a tabulation of absences of less than one day can be made with fair accuracy. If a patient with a disabling dental condition is returned to work in the yard he is saved exactly as many hours as remain in his working day, for he would otherwise receive a pass on which there is no provision for return the same day. A nondisabling case returned to work also deserves to be assigned some time value, since sufficient complaint existed to bring the worker to the dispensary, and he might easily have been thought deserving of a pass to go outside had not dental advice or treatment been available. Civilian cases have, therefore,

been logged under the headings DW (disabling, returned to work), NDW (nondisabling, returned to work), and DH (disabling, sent home), and an arbitrary time saving assigned to the NDW cases of one-half the saving found in DW cases. An analyses of cases for the first 6 months in 1945 is given in the following table:

TABLE 1.—*Number of civilian emergency cases 1 January to 30 June 1945 and man-hours saved in absences of less than 1 day, New York naval shipyard*

Case type	Total cases	Cases per day	Total man-hours saved	Man-hours saved per case	Man-hours saved per day
Disabling; to work	382	2.44	2,032	5.3	13.0
Nondisabling; to work	176	1.12	¹ (475)	¹ 2.7	3.0
Disabling; to home	75	0.48	0	0	0
All types	633	4.04	(2,507)	(4.0)	16.0

¹ Arbitrary value estimated from man-hours saved per DW case.

The time saved is thus seen to be 16 man-hours per day. This is a worthy saving since it represents only about 40 minutes of the operating time of one dental officer (at 10 minutes per case). It seems very small, however, in comparison with the total of dental absenteeism partially indicated by 153 man-hours lost in absences of more than 1 day.

The question may be asked whether the palliative emergency dental service may have reduced absences of a day or more as well as absences of less than 1 day. To answer this would require a number of studies of sick-leave applications carefully correlated, and even then inaccuracies would result. Serious fluctuations in absenteeism are known to occur for temperamental and seasonal reasons and such fluctuations might easily influence the reports of dental disability to a much larger extent than would a dental service as small as the present one. Moreover, the measurement of the systemic effects of dental disease is an important part of the picture and presents so difficult a problem that nowhere has it been accomplished as yet, even under ideal statistical conditions. For these reasons, further study of sick-leave applications has not been attempted. There is reason, however, to believe that some effect does exist. Patients, after palliative treatment of acute conditions, frequently state that had they not been referred to the dental office they would have "waited till tomorrow and taken a whole day off." Anyone in supervisory capacity who may feel that time away from the shop to visit the dental office is an unnecessary loss should be aware of this tendency on the part of the worker.

Discussion of cases treated in the dental office has so far been centered on non-occupational dental conditions with passing mention of a very

few traumatic injuries to the teeth. A brief word on possible physical or chemical hazards to the teeth to be found in the yard, other than the chance of traumatic injury, is therefore in order.

No oral manifestations of occupational disease have been encountered during the 8 months the dental service has been in existence. This does not mean that certain hazards do not exist. The writer discussed with the Industrial Health Officer of the yard (who has both medical and dental degrees) the contents of Schour and Sarnat's table of oral manifestations of occupational disease by etiologic agent (2). The Industrial Health Officer reported that several of the substances listed as hazards did exist in the yard, among them acids (hydrochloric and sulfuric), brass, bronze, copper, iron, nickel, lead (but not in paint, which is mostly zinc chromate now), mercury (in gyro-compass work), zinc chloride (in soldering flux), benzol, tar, dusts, atmospheric increase (diving), radium and x-ray. All of these hazards were under control for medical reasons and in none have specific dental symptoms been observed. The x-ray and radium workers are given thorough periodic physical examinations. The writer has performed a number of these examinations and has seen no symptoms as yet not easily accounted for by the usual non-occupational dental diseases.

A reliable negative answer on the question of hazards would require a dental survey of the entire yard with thorough examinations of all workers known to use any substance ever described as hazardous and further examinations of groups using new or hitherto unstudied agents. Such a survey would constitute a valuable peacetime project, but hardly deserved attention while wartime schedules were in effect.

A final word is in order as to the type of civilian personnel drawn to the dental office for emergency service. All were potential private patients, to be sure, yet they were Civil Service employees not receiving quite as high salaries as were usually associated with private corporations doing war work. They were on the job 9 hours a day and, because of the wartime shortage of civilian dentists and the remoteness of the yard from most professional offices, they sometimes could not obtain private dental care within days or weeks after the onset of dental pain. Many were ignorant, both in a general sense and in matters of dental health. Almost none were malingerers (and why should a malingerer come to a dental office?). Those patients who reported with nondisabling conditions were found to come almost without exception for advice on a suspected serious condition or for replacement of a lost temporary filling rather than for a pass to go home. All patients were appreciative of the service rendered and it is the writer's belief that considerable good will was engendered.

COMMENT

The palliative dental emergency dental service here described appears to have made a good beginning. Any dental case sufficiently acute to attract sympathetic attention stands a good chance of reaching the dental office. A fair number of such cases are actually relieved of pain and returned to work each day from the dental office. Yet expansion of the service would seem logical, particularly in peacetime. Only 4 patients a day are treated from among 65,000 civilian workers and less than one-tenth of the known dental absenteeism has been controlled.

Heacock has stated (3) that in a plant of the Hood Rubber Company a group of 2,000 workers provides 8 emergency calls on the average day. At the Metropolitan Life Insurance Company, New York, with 11,000 Home Office employees, 3.4 emergency calls are received per day relating to conditions where an outside dental appointment would otherwise have been necessary (4). These reports indicate approximate rates of 4.0 and 0.3 calls respectively per 1,000 workers per day. Of the two groups, the Hood Rubber Co. workers probably approximate the yard workers most closely, since the Metropolitan Insurance group is composed chiefly of white collar workers who have had the benefit of an intensive dental service emphasizing prevention. The emergency rate would naturally be lower in such a group than in one where no preventive efforts have as yet been made. On the basis of these reports one would expect the emergency calls at New York Naval Shipyard to vary between 20 and 260 a day, with a strong tendency toward the larger figure.

If in the future an expansion and further publicizing of the industrial dental service in the yard should become possible, a fertile and deserving field should open for dental health education and preventive service within limits already laid down by the American Dental Association.

SUMMARY

1. A study of sick leave applications at New York Naval Shipyard has shown 153 man-hours to be lost each working day for dental reasons, in absences of more than 1 day.

2. A palliative emergency dental service for civilian yard workers has reached an average of four patients a day and resulted in a saving of 16 man-hours per day in absences of less than 1 day.

3. Current inquiry reveals that all substances which might commonly constitute hazards to the teeth of workers are under control for medical reasons. No oral manifestations of occupational disease have been found.

REFERENCES

1. Committee on Economics, American Dental Association: Dental service in industry. *J. A. D. A.* **29**: 299-301, Feb. 1942.
2. SCHOUB, I. and SARNAT, B. G.: Oral manifestations of occupational origin. *J. A. M. A.* **120**: 1197-1207, Dec. 12, 1942.
3. HEACOCK, L. D.: Personal communication to author.
4. Metropolitan Life Insurance Company, New York. Data from records of Dental Division, 1945.



EFFECT OF VITAMIN E IN CORONARY HEART DISEASE

"While studying the effect of high-dosage vitamin E (α -tocopherol acetate) on purpura, the good influence of this factor upon coronary heart disease became apparent. A study of a series of cardiac patients, carried out with the help of Mr. Floyd Skelton and Dr. Wilfrid Shute, has suggested: (a) vitamin E in large dosage (200-600 mgm. Ephynal-Hoffman-LaRoche) has no apparent effect upon normal hearts, even after administration for many months on end; (b) its effect upon patients having congestive heart disease and the anginal syndrome is marked; it increases exercise tolerance and diminishes or abolishes anginal pain during the period of its administration; its diuretic effect is pronounced.

"The effect of vitamin E upon coronary pain may be produced by a direct action on the coronary vessels or by influencing the metabolism of the heart muscle. The first possibility is suggested by an older observation on the effect of vitamin E in dilating the local capillaries in senile vulvitis. Our work on the purpuras raises another possibility, too. Small hemorrhages into the walls of the coronaries or into the heart muscle itself may produce such pain. It is now clear that such extravasations may be either prevented or reabsorbed by means of vitamin E.

"When vitamin E was given in large doses over long periods of time, some patients complained of cardiac irregularities. These were relieved by reducing the medication to low levels."—VOGELSANG, A. and SCHUTE, E. V.: Effect of vitamin E in coronary heart disease. *Nature* **157**: 772, June 8, 1946.

DYSTROPHIA MYOTONICA (MYOTONIA ATROPHICA)

With Report of a Case

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Dystrophia myotonica (myotonia atrophica) may be defined as a heredofamilial disease characterized by:

(1) Myotonia, which is the persistent muscular contraction following stimulation of a muscle, whether this be voluntary, mechanical, electrical, or reflex. If voluntary, the muscle cannot be relaxed immediately, and the contraction may persist for almost a minute until the muscle is returned to the original resting condition. This increased muscular tonicity, which is one of the most constant features in this disease, may become absent as the condition progresses, and although generalized usually to muscles of the upper and lower extremities may become limited to a few muscles usually in the hands;

(2) Progressive muscular weakness and atrophy of muscles most frequently beginning in the muscles of mastication, face muscles, the forearm muscles as well as those of the hands, and the dorsiflexors of the feet. The face becomes strikingly expressionless, haggard, gaunt, and blank; and

(3) Extra-dystrophic phenomena which include: (a) Presenile cataract; (b) Atrophy of the testicles in the male with concomitant impotence; (c) Disturbance of menstruation and frigidity in the female; (d) Characteristic baldness of the frontal portion of the scalp; (e) Endocrine disturbances including hypothyroidism or even rare instances of hyperthyroidism with occasional adenomatous goiter with hyperthyroidism, and decreased blood cholesterol; (f) Various affections of the autonomic nervous system; and (g) Mental changes including decreased intelligence.

Erb (1) in 1886 wrote his famous monograph on Thomsen's disease (myotonia congenita) elaborating the concept of myotonia and describing in detail the clinical picture and pathological manifestation

of myotonia congenita, at the same time describing the characteristic responses and reactions of myotonic muscles to electrical stimulation. Thomsen (2), in 1876, in his dissertation on congenital myotonia, drew heavily from Bell's (3) original description of this disorder. Numerous observers, among them Deleage (4) in 1890 reported cases that they believed to be atypical forms of myotonia congenita. His description of his case was soon followed by other reports of more typical cases by authors including Jacoby (5), Pelizaeus (6), and Hoffmann (7). In 1902 Rossolimo (8) (9) clarified the picture by giving the syndrome the name of myotonia atrophica although he believed the atrophy to have complicated an earlier pre-existing Thomsen's disease. In 1909 there appeared simultaneously, but independently, the publication of Batten and Gibb (10), and that of Steinert (11). Two years later Greenfield (12) first noted the concomitant occurrence of cataract in myotonia and described a family of thirteen siblings of whom five were afflicted with myotonia atrophica, two with cataract, three without cataract, and two with cataract alone. In 1912 Hoffmann (13) reported four cases of myotonia atrophica with cataract. Curschmann (14) (15) in 1914 first emphasized the extra-muscular symptoms and the importance of cataract in myotonia atrophica and gave the disease the name of "dystrophia myotonica." Fleischer (16), in 1918, first pointed out the hereditary tendencies of this disease when, after studying the families of 33 patients with myotonia atrophica, he concluded that the disease was heredofamilial.

ETIOLOGY

The disease is believed to be in all probability heredofamilial. Ravin and Waring (17) concluded that this disease entity was explained as a dominant mutation. It has been considered as involvement of the parathyroids and even a pluriglandular disorder. It has also been pointed out in dystrophia myotonica that the onset of the disease is at an earlier age in each succeeding generation and that the disease increases in severity in succeeding generations. Bleisher, in his work on cataract, emphasized the familial tendencies. Maas and Paterson (18) have observed this disease in cases as young as 3 years of age, and in adults as old as 70. Actually, it occurs most commonly between the ages of 18 and 36 and affects males predominantly. The onset is usually an insidious one, and the symptoms and signs then appear gradually.

PATHOLOGY

Not many cases of dystrophia myotonica have come to post-mortem and but few have been reported. The chief findings are in the face muscles, sternocleidomastoids, forearm, arm, and dorsiflexors of the



FIGURE 1.—Pre-illness, 1944.

feet. The muscular pathology is said to be identical with that of other types of muscular dystrophy (Erb and Landouzy-Dejerine). The nuclei of the abnormal fibers are enlarged and usually increased in number. Later, the muscle fibers disappear entirely leaving intact the rows of nuclei. Testicular and ovarian atrophy is seen as well as cataract, alopecia, and endocrine system changes. Berkman (19) has described a case of adenomatous goiter with hyperthyroidism associated with myotonic dystrophy. Steinert (20) noted changes in the posterior tracts. Bing (21) points out pituitary changes particularly in the anterior lobe as well as changes in the adrenal cortex all with atrophic degeneration.

CLINICAL SYMPTOMS AND SIGNS

The typical case of myotonia atrophica is characterized by progressive muscular weakness and atrophy, myotonia or increased muscular tone, and extra-muscular symptoms including presenile cataract, testicular atrophy, premature baldness usually of the frontal portion

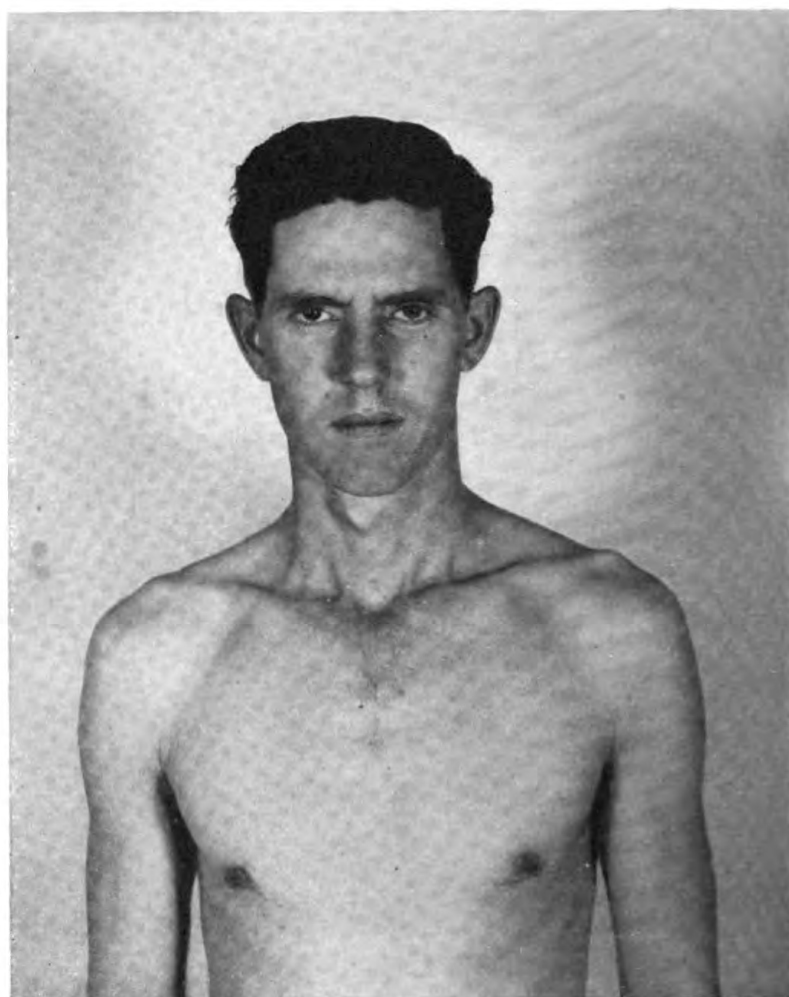


FIGURE 2.—Asymmetry of face with pulling to left.

of the scalp, disturbance of the endocrine glands, disturbances of the autonomic nervous system, and mental changes.

Characteristically, the face is noted to be thin, wasted, gaunt, and haggard. As the disease progresses, the patient develops the typical myopathic facies which is masklike and emotionless with little if any alteration in expression. There is weakness in opening and closing of the lids, or in blowing out the cheeks. The speech becomes low, soft, monotonous, and in the later stages high-pitched, nasal, and almost indistinct. Baldness of the frontal portion of the scalp is quite common, but is rarely seen in the female. Atrophy of the sternocleidomastoids becomes more and more apparent when the patient turns his head from side to side, and the neck becomes markedly thinned. A patient in the final stages of the disease can hardly support his head due to his neck muscles which have become ribbonlike. Wasting and weakness is prevalent in the muscles of the trunk and extremities, and the patient complains of difficulty and of fatigue in carrying out active

movements. Characteristic selectivity is seen in the muscles of the thenar and hypothenar groups and in the deltoids which reveal atrophy. In the lower extremity there is weakness and wasting, seen chiefly in the peroneal group of muscles. The gait becomes slow, uncertain, cumbersome, slapping, and almost steppage, and the patient must pay attention to his steps or he may fall. There may be seen quite often a positive Romberg sign. Associated with the muscle changes may be present decreased or absent deep-tendon reflexes of both extremities. Superficial reflexes may be affected as well. Myotonia (active) may be seen when a patient complains of slowness of movement and difficulty in relaxing his grip. Some patients may even reveal weakness and difficulty in masticating. Muscles of the forearm and hand are most involved, more so than those in the face and legs. The myotonic muscle after a voluntary contraction remains in a persistent contraction state for as much as a minute before it relaxes slowly and sufficiently enough to return to its normal resting state. Alcohol, adrenalin, and quinine usually cause a decrease in

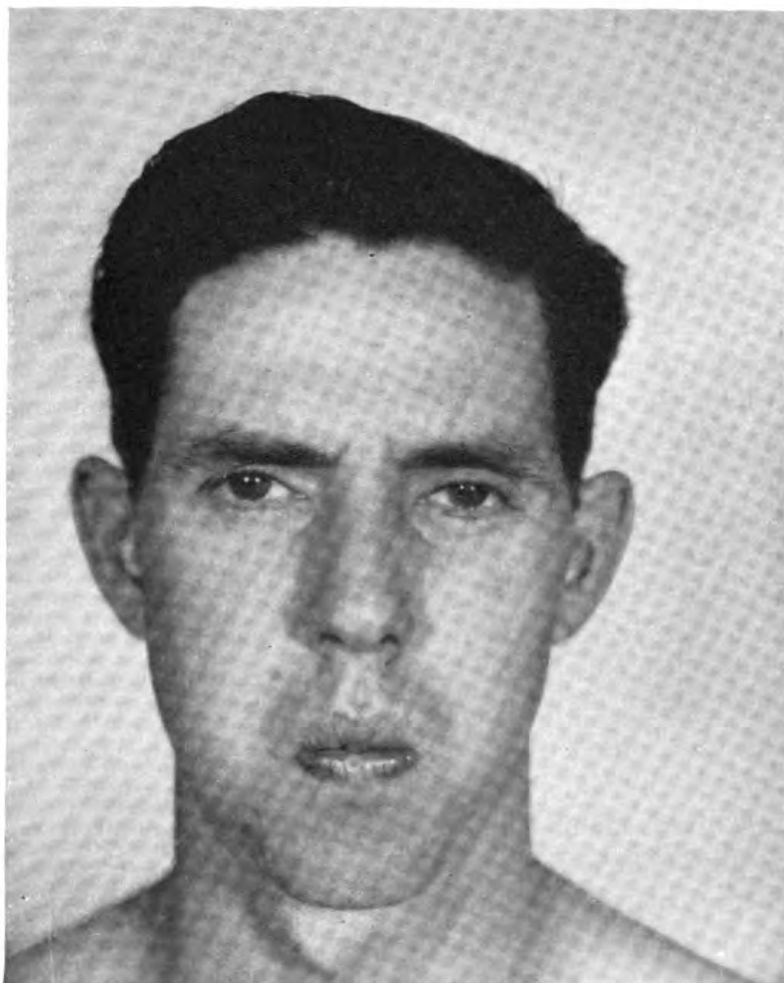


FIGURE 3.—Asymmetry of face with pulling to left.

the myotonia. An increase in this state may be brought about by temperature changes and aggravated emotional states. Percussion of certain small muscle groups, such as those in the tongue, thenar, and hypothenar groups, may result in prolonged contraction with the formation of small depressions or dimples at the site of percussion. This is known as mechanical myotonia. There may be increased excitability elicited when an affected muscle is stimulated either by the faradic or the galvanic current.

The testicles become small, atrophic, and very smooth and with these changes there may result a diminution or poor development of secondary hair signs seen in the beard and on the axillae, chest, abdomen, and pubis. Maas and Paterson have pointed out that in families with light or moderate symptoms there is a prolific state existing but that the products of the unions are of low intelligence. In later generations there results a decrease in the number of children, and also a decrease in the mental abilities. There is also prevalent a high incidence of miscarriage and high infant mortality. This is usually seen in families low in social order and only occasionally in families who have a high social status. Sexual powers are diminished both in the male and female patients. Rarely do these patients marry and because of diminished libido they either remain single or if they do marry only occasionally bear families.

Cataract, which is essentially a presenile one, is present in many of these cases. However, on the basis of the disease being transmitted in a dominant manner, the cataract may be separated out as a cardinal symptom and may be entirely absent. However, cataract is usually found to be one of the most constant findings and if the eyes or the lenses are examined by means of a slit lamp one sees fine dust-like opacities under the anterior and posterior capsules in the early stage and later a so-called radial or starlike formation. This is due to radial projections. Authorities such as Greenfield, Hoffmann, Adie and Greenfield (22), Vogt (23), Fleischer (16), and Mayer and Luhan (24) have contributed greatly in the description of the cataract findings seen so regularly in this disease entity. Cataract seems to be of great significance in the hereditary transmission of this disease because members of affected families might have cataract alone and still have no muscular symptoms whatsoever. Disturbance in thyroid activity has been noted over and over and there may be an increase or a decrease in thyroid function. Cases of acrocyanosis, heart disorders, lung involvements, and thyroid changes associated with dystrophia myotonica have been reported. Observers have demonstrated other abnormalities in the endocrine system with diabetes mellitus, thyroid insufficiency, and changes in the skin being noted. The autonomic nervous system may also show involvements as characterized by increased hydrosis, emotional changes associated with unusual

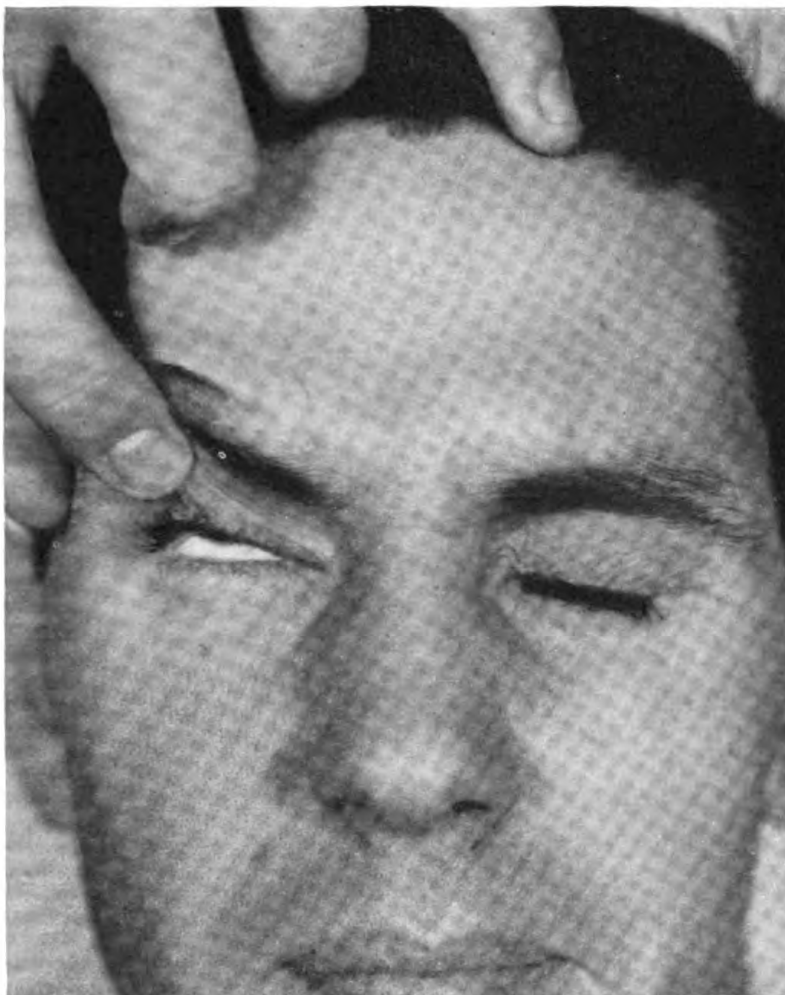


FIGURE 4.—Ptosis of left upper lid.

cheerfulness, flushing of the skin, and some excitability. As far as mental symptoms are concerned most authors agree that these exist. Maas and Paterson have pointed out that families which reveal this infirmity are usually of low intelligence and also low in the social scale. Sometimes mental deficiency dates from birth. Very few patients really reveal true psychotic symptoms during the psychiatric examinations and it is revealed that there are personal defects which are usually the result of the disease rather than being caused by it. Maas and Paterson (25) in an earlier publication stated that they observed abnormal temperaments to the degree that "It consisted in persistent and almost morbid cheerfulness, mild grandiosity, and a lack of drive and initiative." Maas (26) reported that in many cases of dystrophia myotonica there was seen disturbance of the vibration sense.

DIFFERENTIAL DIAGNOSIS

In the differential diagnosis of conditions which are characterized by wasting and weakness of muscles, myotonia atrophica may be considered to be a potential source of error. In its typical form it should present no special problem, but when it is seen in its various degrees it does embody features which are characteristic of other and better known muscular dystrophies. Myotonia congenita, also known as Thomsen's disease, must first be differentiated. S. A. K. Wilson (27), while believing there was a difference between dystrophia myotonica and myotonia congenita, maintained that muscular atrophy could occur in the latter disease. Myasthenia gravis may be associated, especially due to the eye signs and weakness seen in this condition. Bulbar paralysis raises a suspicion. Multiple sclerosis, tabes dorsalis, muscular dystrophies, even arthritis and angina pectoris must be considered in the differential diagnosis of myotonia atrophica.

PROGNOSIS

Death usually results from so-called generalized asthenia which is so often the end or terminal point seen in other cases of muscular dystrophies of long and drawn-out courses. Usually the muscles of respiration may be involved and with this may occur an intercurrent respiratory infection. Occasionally cases of pulmonary tuberculosis have been reported as being the contributory cause of death. Most cases of this disease die around 50 years of age, yet some may even last until the seventieth year.

TREATMENT

Up until the present time there is no specific therapy for this affection. In spite of the fact that there are a great number of remedies recommended in the treatment of this myotonic dystrophy, there is no specific curative theurapeutic agent as yet. Wolf (28), who is one of the most outstanding workers in the therapy of the myotonic state, reported that quinine resulted in striking benefit in these cases. It was noted that quinine abolished the myotonia as long as it was being administered. Wolf had considered quinine as a reasonable drug for diminishing the reflex action as described by Lindsley and Curnen (29) and Lindsley (30) who felt that the after-contraction of myotonia was of reflex origin and was due to the persistent discharge of hyperexcitable sensory end-organs in muscle. A. M. Harvey (31) had suggested that quinine had a curare-like action by which it decreases the excitability of the end-plates. Hesser, Longworthy and Vest (32) have reported some cases of myotonic atrophy which they treated with testosterone propionate with some apparent good results. Recently,

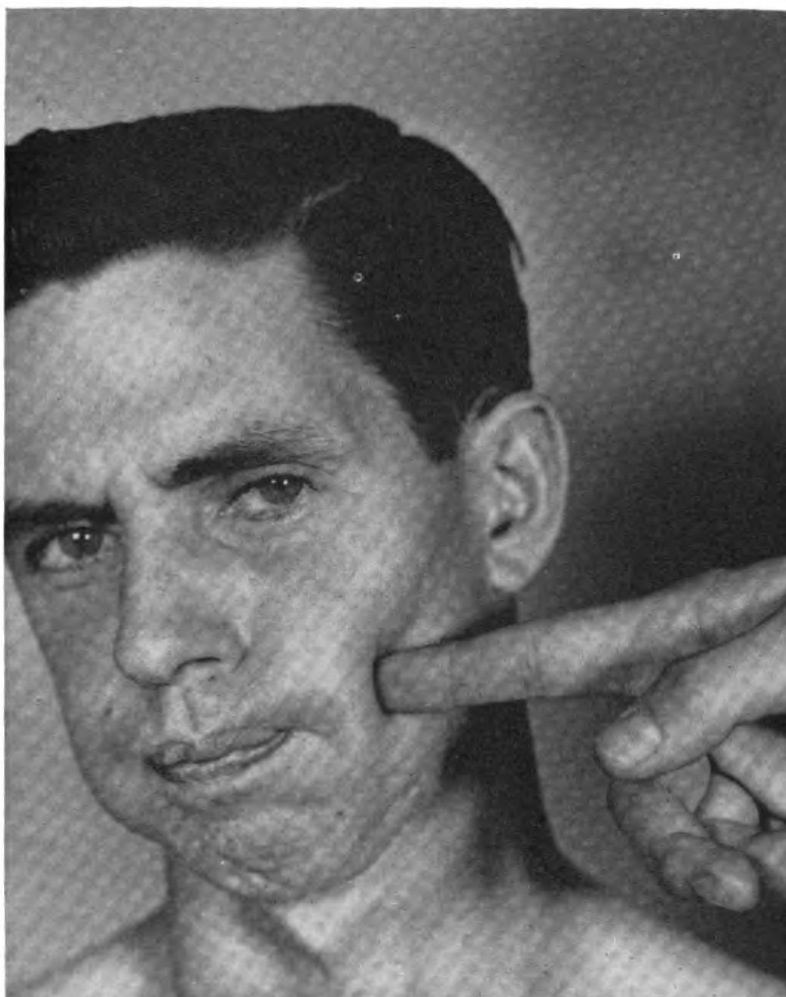


FIGURE 5.—Weakness of frontalis, orbicularis oris, and buccinator muscles.

Mongillo and Serog (33) treated a case of myotonic dystrophy with vitamin E plus male sex hormones and noted an improvement in the general state as well as in the function of some of the muscles. Although the therapy was not curative it was found to be most beneficial and useful. Maintenance dosage of vitamin E is arrived at chiefly by trial. Other observers had given testosterone propionate, calcium, and benzedrine sulfate with varying effects, but none of the authors attached too much benefit to their therapeutic results.

CASE REPORT

A seaman, age 26 years, was first admitted to the sick list on 22 February 1945 complaining of an inability to voluntarily relax contracted muscles of the forearms and hands stating, "My hands are weak, and I am weak all over." His parents were both living, but his father had a "leaking heart." There were 3 brothers living and well. As far as he knew, there was no one in his family who suffered from muscular weakness, had difficulty in relaxing the hand grasp, or who

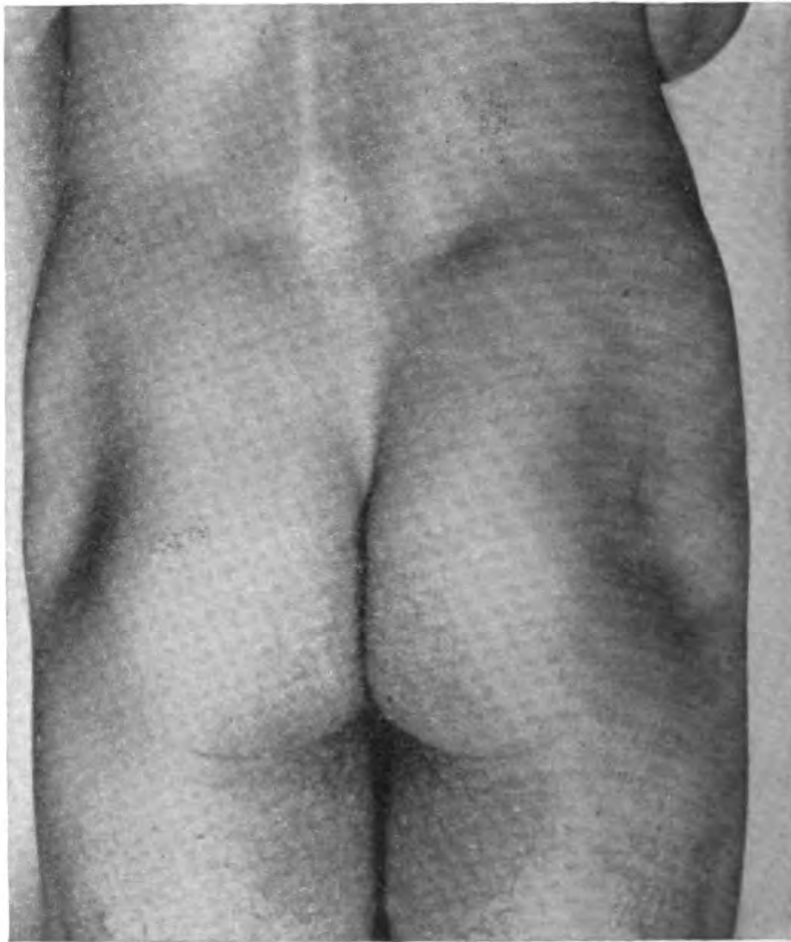


FIGURE 6.—Atrophy of glutei.

had cataract. The past history of this young man was without significance except that in 1944 he was found to have a bilateral apical disease diagnosed as inactive tuberculosis and which was observed in a naval hospital for 5 weeks before he was discharged to duty with the diagnosis of "arrested disease." In 1943 he sustained a fracture of his right zygoma which was treated with open reduction. In August 1944, he apparently had a fracture of the head of the right radius. His personal past history was quite uneventful for this man made a normal infancy, childhood, educational, occupational, social, and moral adjustment throughout. At no time, was there any evidence of any abnormal mental activity or behavior noted by himself or by others.

Pre-illness.—By his own statements, this young man admitted a gradual onset of his illness for a period of about 1 year. He stated that "My hands began locking on me and I lost my grip." This so-called locking occurred whenever the hand was closed with force. However, his wife stated that she had noted a gradual thinning of her husband's face and neck during the past 2 years. She had no complaints whatsoever of any loss of sexual power in her spouse.

The seaman went on to state that the muscles in his forearm began to develop prolonged hypertonic contractions particularly when he underwent some activity. He also admitted that during the past 1 to 2 years he had noted numbness over the medial sides of his hands and wrists, and stated that these parts would go to sleep rather easily. These symptoms had become progressively worse until the

hand and arm muscles would not undergo any relaxation whatsoever when this was voluntarily attempted. His wife contributed the information that she had noted her husband's health was becoming poorer and poorer. She observed too, that his eyelids were beginning to quiver, and she had observed fibrillations in his right biceps muscles as well as weakness in her husband's grip. However, there were no complaints of hyperesthesias, speech defects, or mouth changes. Although eyesight and hearing were well within normal limits this man had noted an increased tendency to strangle when he regurgitated fluid through the nose on several occasions. Occasionally some dyspnea upon exertion was noted. He had a mild cough now and then. He complained chiefly of weakness of the feet and that he was fatigued when he walked too much. He at no time had a decrease in sexual desire or potency. There was a weight loss of 20 pounds in the past year (fig. 1).

Examination.—Only the positive findings or those of special significance will be noted. The patient was quite intelligent and cooperative. He was seen to be rather asthenic and poorly developed. Height 6 feet, weight 134 pounds. An asymmetry of the face was noted with a pulling toward the left (figs. 2 and 3). The facial group of muscles seemed atrophic and weak. The left upper lid was ptosed (fig. 4). The patient was unable to form a purse string with the orbicularis oris muscles and he was unable to whistle. There was no evidence of loss of hair nor was there any suggestion of cataract. Visual acuity was within normal limits in both eyes. The temporal muscles revealed some wasting, but the masseters were normal. The facial muscles were atrophied and the typical

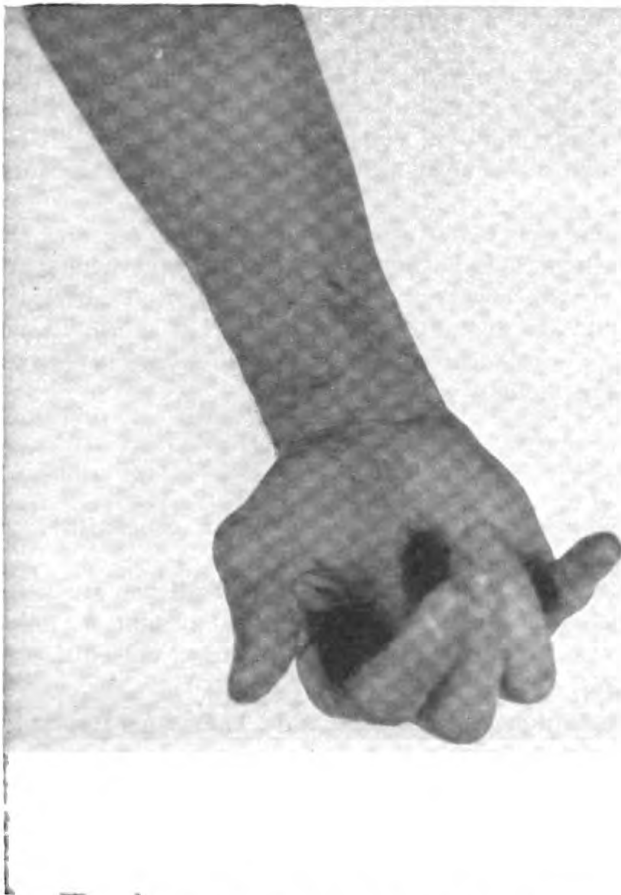


FIGURE 7.—Weak flexion of fingers.

myopathic facies of the dystrophia myotonica type was present with weakness of the frontalis, orbicularis oris, and the buccinator muscles (fig. 5). When the tongue was struck gently with a tongue blade there was definite myotonia noted. The neck revealed marked atrophy of both sternocleidomastoid muscles which were reduced to ribbon-like proportions. There was questionable atrophy of the forearm muscles, but there definitely existed atrophy in the hands of the interossei group bilaterally. Flexion of the fingers was weak (fig. 7). Active myotonia was noted in the hand grasp in that there was weakness of the grip and the left hand grip was somewhat stronger. Anesthesia over the ulnar nerve distribution bilaterally was noted. There was atrophy of the glutei (fig. 6) and there was some weakness of dorsiflexion of the foot and toes with a slight suggestion of walking difficulty. The deep reflexes of the upper extremity were reduced while those in the lower were normal. There were no abnormal or pathological reflexes seen. Absent too were cataract, loss of hair, and testicular atrophy.

Mental examination.—The mental interview revealed no abnormalities that could be discerned. His sensorium was clear throughout, and no reality distortion was evident. He was responsive and answered questions readily and logically. His stream of speech was normal in direction and in flow. Attention was easily gained and well sustained. He was oriented throughout in all spheres. His prevailing mood was one of mild concern and with suggestive depression. No dissociation of affect was apparent. The ideas he expressed and the behavior he manifested were harmonious and congruous. Concentration, retention, and recall were normal. His memory for past and present affairs was good. His general knowledge and information was unimpaired. Judgment and insight were not affected.

Laboratory findings.—Laboratory data revealed a moderate anemia. The urine was normal throughout, and a creatinine excretion test was normal. A spinal puncture performed revealed findings well within normal limits. X-rays of the chest revealed old arrested tuberculosis of each apex. Other laboratory findings were entirely normal.

Treatment.—The patient was placed on quinine and given 5 grains three times a day for several 2-week periods without any improvement whatsoever in the myotonic symptoms. He was observed over a 4-month period during which time his symptoms and his findings fluctuated but very little, if at all. A letter from the patient received a few weeks ago was to the effect that he was "not feeling any better in spite of all the medicine I am taking."

REFERENCES

1. EBB, W.: Die Thomsen'sche Krankheit (myotonia congenita). F. C. W. Vogel, Leipzig, 1886.
2. THOMSEN, J.: Tonische Krämpfe in willkürlich beweglichen Muskeln in Folge von erbter psychischer Disposition. Arch. f. Psychiat. 6: 702-718, 1876.
3. BELL, C.: The Nervous System of the Human Body. 3d edition. H. Rowlandson, London, 1844.
4. DÉLÉAGE, F.: Étude clinique sur la maladie de Thomsen (Myotonie congénitale). Thèse de Paris, 1890.
5. JACOBY, G. W.: On myotonia. J. Nerv. & Ment. Dis. 25: 508-528, July 1898.
6. PELIZAEUS: Ein Fall von Thomsen'scher Krankheit. Klin. Wchnschr. 28: 609-610, July 12, 1897.

7. HOFFMANN, J.: Zur Lehre von der Thomsen'schen Krankheit mit besonderer Berücksichtigung des dabei vorkommenden Muskelschwundes. *Deutsche Ztschr. f. Nervenhe.* 18: 198-216, 1900.
8. ROSSOLIMO, G.: De la myotonie atrophique. *Nouv. iconog. de la Salpêtrière.* 15: 63-77, 1902.
9. ROSSOLIMO, G.: De la myotonie atrophique. Contribution à la théorie des myopathies. *Neurol. Zentralbl.* 21: 135-136, 1902.
10. BATTEN, F. E., and GIBB, H. P.: Myotonia atrophica. *Brain.* 32: 187-205, 1909.
11. STEINERT, H.: Myopathologische Beiträge. I. Über das klinische und anatomische Bild des Muskelschwunds der Myotoniker. *Deutsche Ztschr. f. Nervenhe.* 37: 58-103, 1909.
12. GREENFIELD, J. G.: Notes on a family of "myotonia atrophica" and early cataract, with report of additional case of "myotonia atrophica." *Rev. Neurol. and Psychiat.* 9: 69-181, April 1911.
13. HOFFMANN, J.: Katarakt bei und neben "Atrophischer Myotonie." *Arch. f. Ophth.* 81: 512, 1912.
14. CURSCHMANN, H.: Über familiäre atrophische Myotonie. *Deutsche Ztschr. f. Nervenhe.* 45: 161-202, 1912.
15. CURSCHMANN, H.: Beobachtungen und Untersuchungen bei atrophischer Myotonie. *Deutsche Ztschr. f. Nervenhe.* 53: 114-129, 1915.
16. FLEISCHER, B.: Über myotonische Dystrophie mit Katarakt. Eine hereditäre, familiäre Degeneration. *Arch. f. Ophth.* 96: 91-133, 1918.
17. RAVIN, A. and WARING, J. J.: Studies in dystrophia myotonica; hereditary aspects. *Am. J. M. Sc.* 197: 593-609, May 1939.
18. MAAS, O., and PATERSON, A. S.: Genetic and familial aspects of dystrophia myotonica. *Brain.* 66: 55-86, Mar. 1943.
19. BERKMAN, J. M.: Hyperthyroidism associated with myotonic dystrophy. *Proc. Staff Meet., Mayo Clinic.* 10: 273-275, May 1935.
20. STEINERT, H.: Ein neuer Fall von atrophischer Myotonie. *Deutsche Ztschr. f. Nervenhe.* 39: 168-182, 1910.
21. BING, R. and HAYMAKER, W.: *Textbook of Nervous Diseases.* C. V. Mosby Company, St. Louis, Mo., 1939.
22. ADIE, W. J., and GREENFIELD, J. G.: Dystrophia myotonica (myotonia atrophica). *Brain* 46: 73-127, May 1923.
23. VOGT, A.: Neue Schweizer Stammbäume con myotonischer Dystrophie (atrophischer Myotonie) aus dem Aargau, St. Gallerland und aus dem Kanton Schaffhausen. *Klin. Monatsbl. f. Augenh.* 72: 421-422, 1924.
24. MAYER, L. L. and LUHAN, J. A.: Myotonia atrophica with cataract; report of 3 cases. *Arch. Neurol. & Psychiat.* 30: 810-823, October 1933.
25. MAAS, O. and PATERSON, A. S.: Mental changes in families affected by dystrophia myotonica. *Lancet.* 1: 21-23, Jan. 2, 1937.
26. MAAS, O.: Disturbances of sensibility in dystrophia myotonica. *Brain,* 61: 449-453, Dec. 1938.
27. WILSON, S. A. K.: *Neurology.* Williams and Wilkins Company, Baltimore, Md., 1940.
28. WOLF, A.: Quinine: effective form of treatment for myotonia: preliminary report of 4 cases. *Arch. Neurol. & Psychiat.* 36: 382-383, Aug. 1936.
29. LINDSLEY, D. B., and CURNEN, E. C.: Electromyographic study of myotonia. *Arch. Neurol. & Psychiat.* 35: 253-269, Feb. 1936.
30. LINDSLEY, D. B.: Electromyographic studies of neuromuscular disorders. *Arch. Neurol. & Psychiat.* 36: 128-157, July 1936.
31. HARVEY, A. M.: Mechanism of action of quinine in myotonia and myasthenia. *J. A. M. A.* 112: 1562-1563, April 22, 1939.

32. HESSER, F. H., LONGWORTHY, O. R., and VEST, S. A.: Muscle strength in myotonia atrophica (dystrophia myotonica) improved by testosterone propionate. *Endocrinology* 26: 241-243, Feb. 1940.
33. MONGILLO, B. B. and SEROG, M.: Myotonic dystrophy. *J. Nerv. & Ment. Dis.* 99: 906-921, June 1944.



A COMBINATION TREATMENT FOR LICE AND SCABIES

Author's discussion.—In general an aqueous emulsion would prove less desirable against head lice than an alcoholic solution. The solution usually evaporates much quicker and is more pleasant to use than the emulsion. Rapid evaporation or drying appears to be about the only advantage the alcoholic formula has over the emulsion. However, of the several hundred cases of head lice treated with NBIN, few patients considered the treatment objectionable, and most of them found it pleasant. The presence of the treatment agent is not detectable within a few hours after application.

Treatment for crab lice or scabies should cause as little irritation as possible, since they must be applied to the more tender areas, such as the genital region. Most of the treatments now in wide use against crab lice or scabies are either ointments or emulsions. No doubt this is due mostly to the fact that there are no pleasant, non-irritating effective compounds available for other types of preparations. Vehicles that are nontoxic and non-irritating when applied in undiluted form to the more tender areas of the body are urgently needed for various formulations.

No cases of dermatitis have resulted from treatment made with the formulas discussed in this report. The emulsions have a slight smarting effect on open lesions and on the genitals, but this is of short duration. The formula is considered much less irritating than the benzyl benzoate emulsions now used for scabies, since it contains only about half as much benzyl benzoate. Alcoholic solutions are objectionable because of their rather intense, although temporary, burning of the genitals.

The foregoing discussion is based mostly on laboratory and carefully controlled clinical tests. However, extensive field tests against lice and scabies have been made with the NBIN formula. The results of these tests will be reported later.—EDDY, G. W.: Combination treatment for lice and scabies. *J. Invest. Dermat.* 7: 85-91, April 1946.

DETERMINATION OF THE PENICILLIN SENSITIVITY OF BACTERIA ¹

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In the course of administering penicillin in the treatment of relapsing fever and in the contemplated use of the drug in the treatment of cholera, it was found necessary to standardize certain strains of bacteria against penicillin for the purposes of (a) determining the potency of different lots of the drug under different conditions as met with in the Tropics; (b) determining the penicillin content of the body fluids; and (c) determining the *in vitro* effect of penicillin against specific organisms.

Two methods were used: The trench plate method described in the BuMed News Letter (1) with certain modifications and a semisolid method patterned after Dr. A. T. Wilson's method for testing resistance of hemolytic streptococci to the sulfonamides (2). The work done with each method is herein described in detail.

MODIFIED TRENCH PLATE METHOD

Plates containing 20 cc. of Difco proteose agar No. 3 with 0.3 per cent beef extract were prepared and allowed to dry. A trench 1 cm. wide was cut through the center of the plate from end to end and filled with a 3 cc. mixture of the same media containing varying strengths of penicillin. (NOTE: The agar mixture must be cooled below 50° C. before adding the penicillin.) The plates were further allowed to dry until completely free of moisture both on the surface of the trench and the remainder of the plate. This requires about 4 hours in the incubator and is very essential to prevent the growth from spreading beyond the desired area. Plain rather than blood agar plates were used due to the difficulty in obtaining sterile defibrinated blood. In preliminary tests no difference could be discerned in testing on either type of media.

The organisms to be tested were grown in 5 cc. of tryptose phosphate broth for 6 hours and a large loop (3 mm. in diam.) of a 1:10 dilution was streaked across the trench in the form of a band the width of the loop. The lowest concentration of penicillin producing complete in-

¹ From Epidemiology Unit No. 50.

hibition in the trench was considered the titer of penicillin sensitivity (3). It is felt that this is a more accurate end-point than measuring the comparative distance of inhibition from the trench of the various organisms, as stated in the BuMed News Letter, as it is questionable whether the penicillin is absorbed into the surrounding media beyond 2 cm. from the edge of the trench, and in any case absorption varies considerably with the age and moisture content of the plate.

The following organisms were tested:

1. ET 2, El Tor Cholera isolated in 1902;
2. ET 10, Ogawa Cholera isolated in Japan in 1930. These vibrios were alternately grown on proteose agar slants of pH 7.3 and pH 9 to produce characteristic growth of the organisms; the tryptose phosphate broth was inoculated from the pH 7.3 slant;
3. ST 1, *Staphylococcus aureus*, Oxford-Cairo-Beirut strain obtained from the American University of Beirut; and
4. Affifi, a hemolytic strain of *S. aureus* isolated in March 1945 from the smallpox pustules of a 12-year old Egyptian boy in the eighth day of illness. He had received 200,000 units of penicillin in the 48 hours preceeding the culturing of the organism.

Squibb penicillin sodium, 100,000 units per vial (expiration date 6 December 1945) was used in the tests. One-in-ten dilutions were made with sterile isotonic saline solution down to 1 cc.-0.1 unit and all dilutions were made to 10 cc. to minimize dilution errors. The four strains were at times tested simultaneously on one plate and, if the plates are completely free of moisture, it is believed that at least six strains can be tested on the same plate to save time and materials.

TABLE 1.—Points at which *Affix* and *ST 1* strains were inhibited by penicillin in the trench

Organism	Units of penicillin per cubic centimeter of mixture													
	Control	.01	.02	.04	.06	.08	0.1	1.0	1.5	2.0	2.2	2.5	2.8	4
<i>Affix</i>	++++	++++	++++	++++	++	++	++	++	+	±	±	—	—	—
<i>ST 1</i>	++++	++++	++++	++++	++	++	++	++	+	±	±	—	—	—

TABLE 2.—Points at which *ET 2* and *ET 10* strains were inhibited by penicillin in the trench

Organism	Units of penicillin per cubic centimeter of mixture																		
	Control	5	6	7	8	9	10	10.5	11	12	15	18	20	21	22	22.5	23	24	25
ET 2	++++	++++	++++	++++	++++	++++	++++	++++	++++	++++	++++	++++	++	+	+	±	—	—	—
ET 10	++++	++++	++++	++++	++++	++++	++++	++++	++++	++++	++++	++++	++	+	+	—	—	—	—

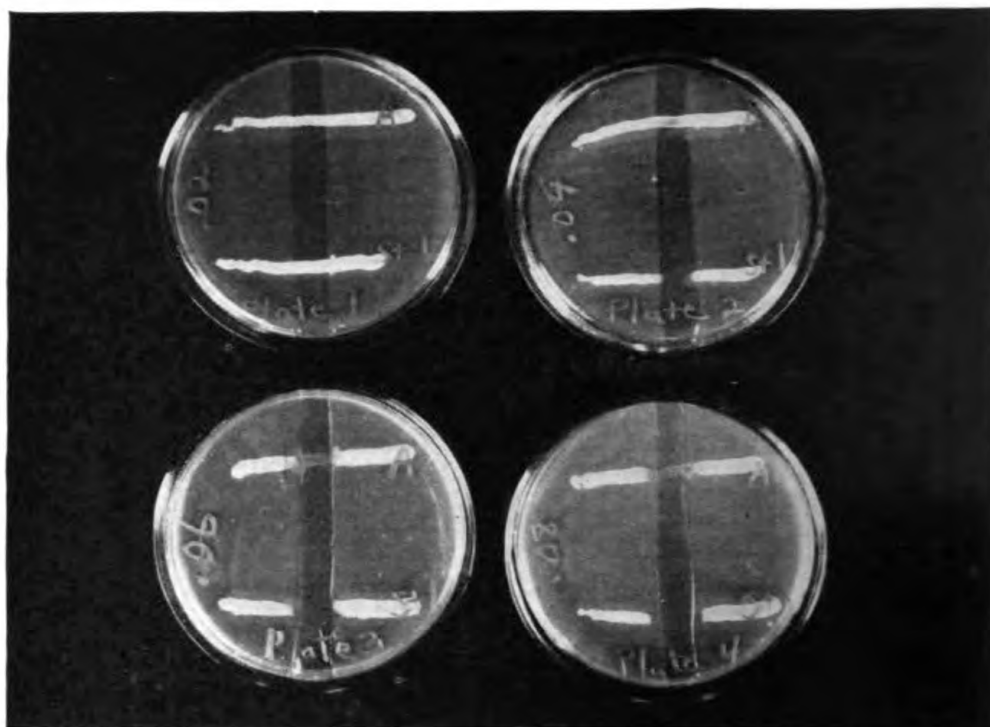


FIGURE 1.—Plate 1 shows heavy growth (++++ of both **Affi** and **ST 1** across the trench containing .02 units of penicillin per cc. of trench mixture. Plate 2 shows **Affi** with a very slight amount of inhibition (+++) and **ST 1** almost completely inhibited (+) in the trench. Plates 3 and 4 show definite partial inhibition (++) of **Affi** and complete inhibition of **ST 1**.

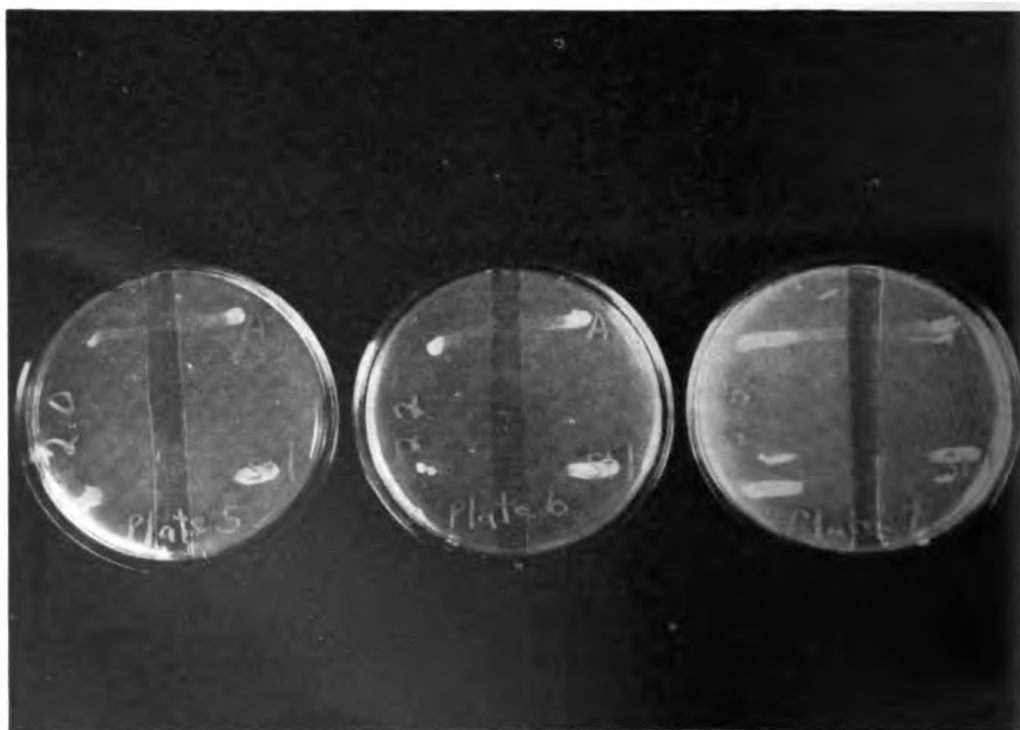


FIGURE 2.—Plates 5 and 6 still show a few scattered colonies (+) of **Affi** staphylococcus in the trench but plate 7 shows complete inhibition.

Tables 1 and 2 show the points at which these strains were inhibited by the penicillin in the trench.

Readings were made as follows:

- ++++ Heavy growth on the surface of the trench.
- +++ Definite but slight inhibition with growth still covering the entire streak.
- ++ Definite inhibition with some areas of complete inhibition in the trench.
- +
- + Scattered isolated colonies in the trench.
- ± Few isolated colonies at the edges of the trench only.

Figures 1, 2, 3, and 4 show the tests and various end-points.

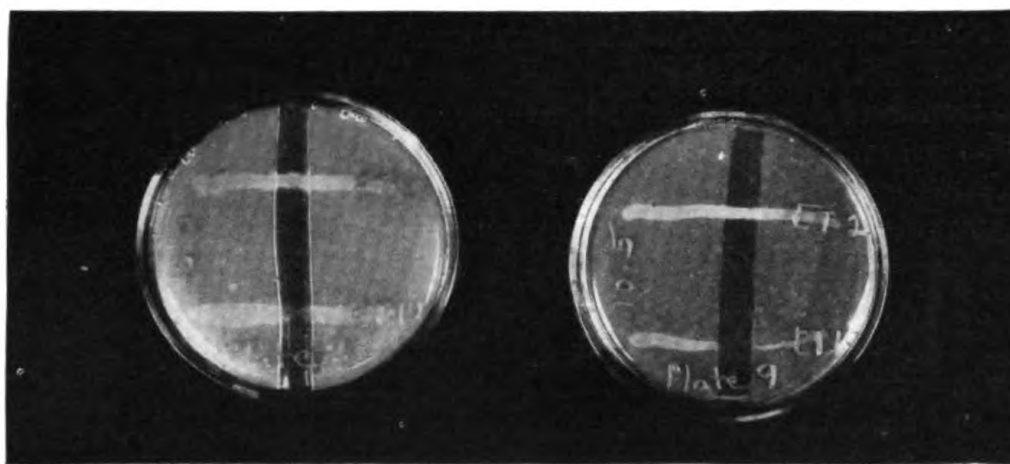


FIGURE 3.—Plate 8 shows partial inhibition (+) of ET 10 and plate 9 shows practically complete inhibition (±) in the trench. A few scattered colonies may still be seen at the edge of the trench. Both plates showed no inhibition of ET 2.

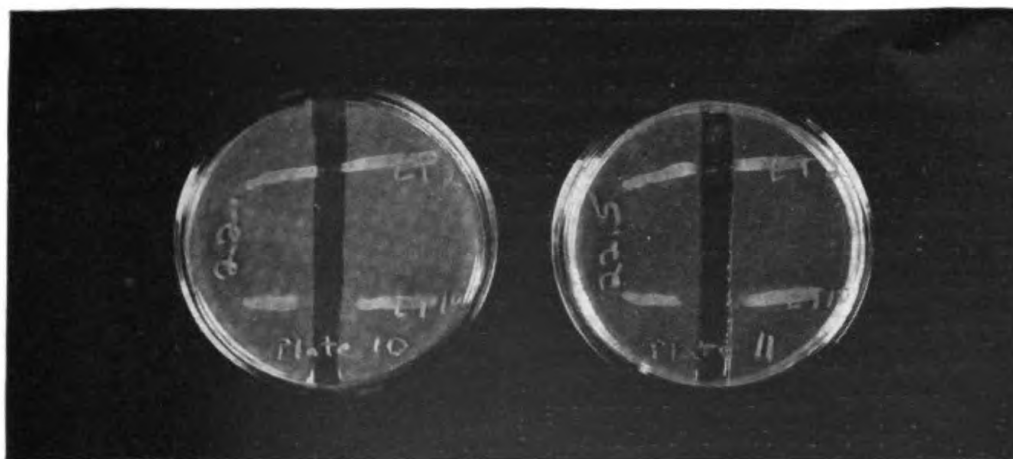


FIGURE 4.—Plate 10 shows inhibition (+) of ET 2 in the center of the trench but there is still heavy growth at the edges. Plate 11 shows practically complete inhibition (±) of ET 2 except for a very few scattered colonies.

Summary of Modified Trench Plate Method

Four strains of bacteria were tested for their penicillin titer using a trench plate technique with the following results:

Strain	Penicillin titer	Strain	Penicillin titer
Affia	2.5 units	ET 2	23 units
ST 1	.06 unit	ET 10	11 units

SEMISOLID METHOD

A semisolid method for testing the penicillin sensitivity of bacteria so as to determine the presence of any growth by inspection will now be described. In using a liquid medium it is often necessary to subculture the liquid on a plate to determine whether or not growth is present and thereby a day's time may be lost in evaluating the test. The tests for penicillin sensitivity using agar or other type plates are often time and material consuming. It is felt that the method described is as accurate as any others used in this laboratory and requires a minimum amount of time and material.

The organism to be tested is inoculated into 2 cc. of tryptose phosphate broth, incubated for 12 to 18 hours and a very small loop of this broth culture diluted in 2 cc. more of tryptose phosphate broth. The loop should be just large enough to admit an 18 gauge needle and should be touched to the side of the broth culture tube when withdrawing so as to further minimize the size of the transfer. Using the same loop and the same technique, a loopful of the diluent is then transferred to a 3 cc. tube of semisolid tryptose phosphate broth containing a measured amount of penicillin and incubated overnight. The optimum amount of agar was found to be .175 percent; this properly suspended the colonies and eliminated the possibility of mistaking any broth sediment for bacterial growth.

The tubes of semisolid media are examined after incubation and the titer of penicillin noted as the first tube showing no growth. The growth will be seen as colonies individually suspended in the media and if a properly diluted inoculum is used there should be between 50 and 100 suspended colonies in the control tube. The end point is very sharp and eliminates the necessity of streaking on a plate to determine whether or not growth is present.

Readings are made as follows:

- ++++ 50 to 100 colonies.
- +++ 25 to 50 colonies.
- ++ 10 to 25 colonies.
- + 1 to 10 colonies.

Figures 5 and 6 show the end-point. An obvious disadvantage of this method is that it can not be used for testing motile organisms.

The penicillin titer of three strains of *S. aureus* were determined by this method.

1. Affi : Described previously.
2. ST 1 : Described previously.
3. SP : *S. aureus* isolated in April 1945 from the smallpox pustules of a 5-year old Egyptian boy in the third day of illness.

Squibb penicillin sodium, 100,000 units per vial (expiration date 6 December 1945) was used in the tests. One-in-ten dilutions were made with sterile isotonic saline solution down to 1 cc.—0.1 unit and all dilutions were made to 10 cc. to minimize dilution errors. Table 3 shows the titer obtained.

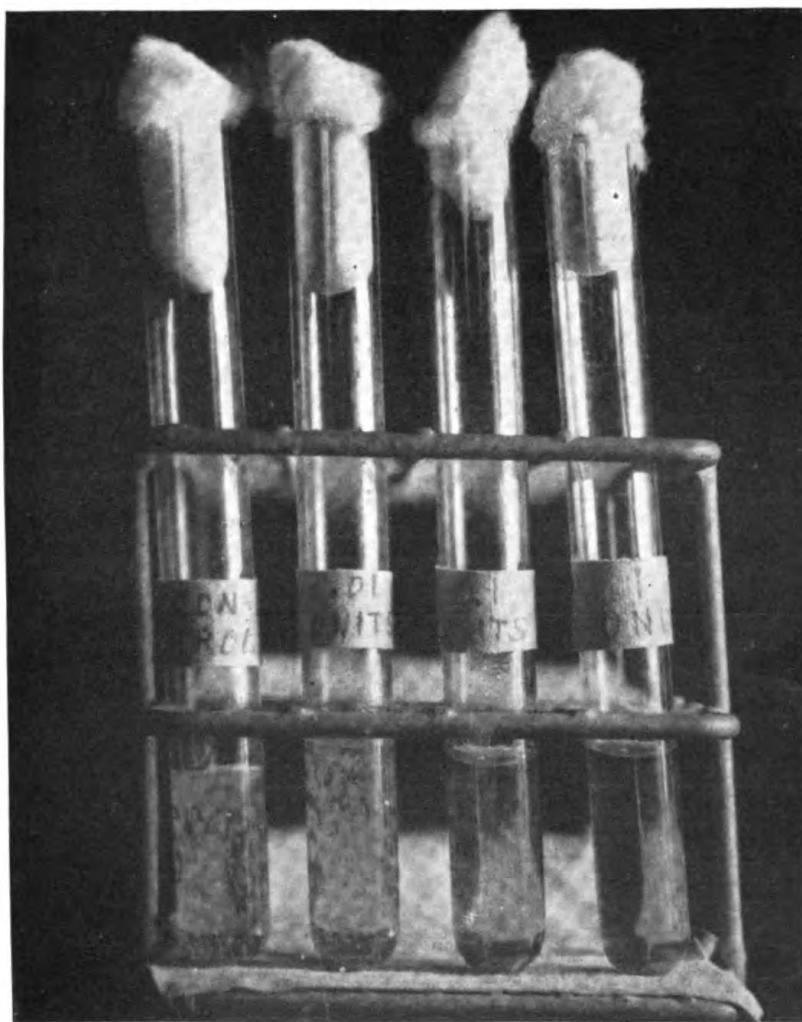


FIGURE 5.—Determination of penicillin titer. The end-point is sharp and definite. There is heavy growth (++++) in the tube containing 0.01 units of penicillin and complete inhibition of growth in the tube containing 0.1 units of penicillin.

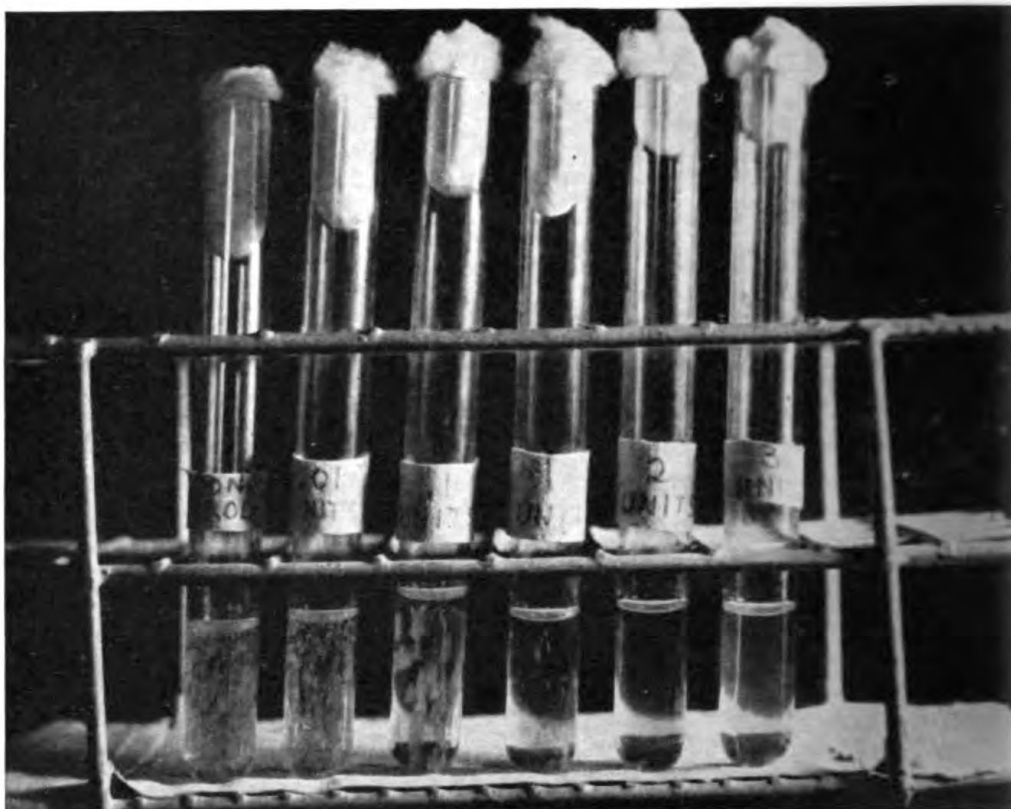


FIGURE 6.—Determination of penicillin titer. The end-point is more gradual than in figure 5 but still sharp and definite. There are a number of colonies in the tube containing 1 unit of penicillin (+), but complete inhibition in the tube containing 2 units of penicillin.

TABLE 3

Organism	Units of penicillin in the media						
	Control	0.01	0.1	1	2	3	4
Affn.....	++++	++++	++++	++++	+++	—	—
ST 1.....	++++	++	—	—	—	—	—
SP.....	++++	++++	++++	—	—	—	—

This method also may be used in determining the amount of penicillin in the body fluids by standardizing a strain of staphylococcus against penicillin and determining the amount of body fluid being tested that is necessary to inhibit the growth of the standardized strain. Sterile agar may be added to the broth-body-fluid mixture if necessary to create a semisolid consistency. Figures 7 and 8 show the technique applied in determining the amount of penicillin excreted in the urine. The urine of relapsing fever patients receiving 25,000 units of penicillin every 3 hours was tested by this method. Urine voided 1 hour after injection contained 20 units of penicillin per cc. No trace of penicillin could be determined in 3-hour urine specimens.

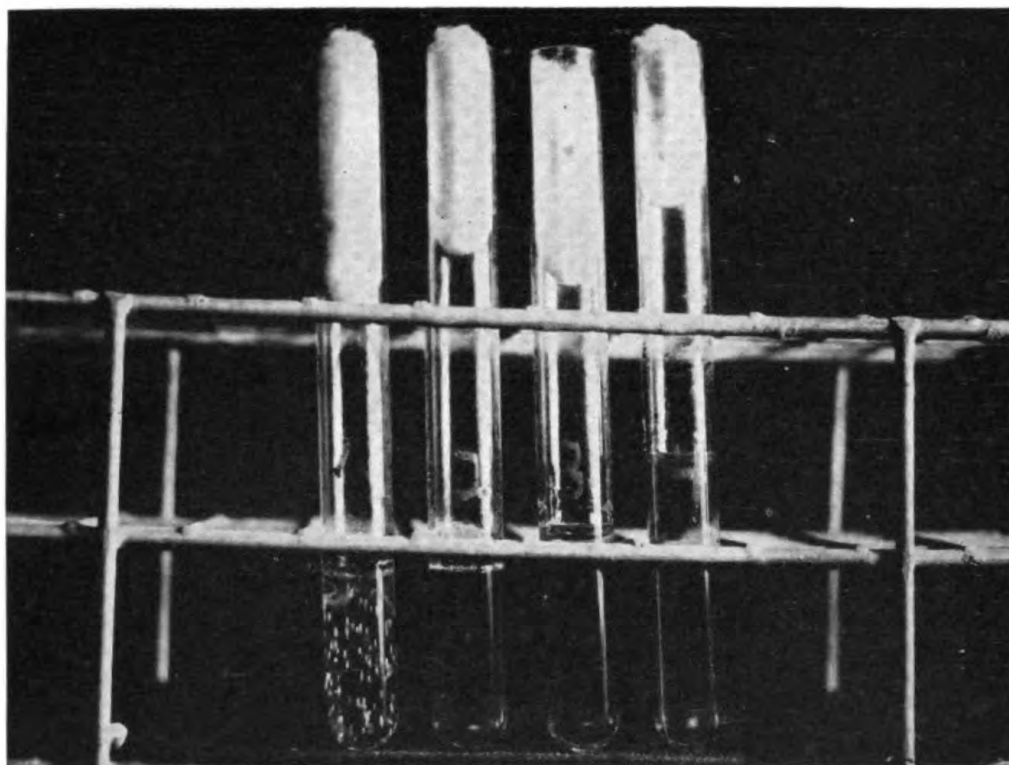


FIGURE 7.—Determination of penicillin in urine. Tube 1 (control tube) contains no urine. Tubes 2, 3, and 4 contain 0.01 cc., 0.1 cc. and 1 cc. of urine respectively. All tubes were inoculated with ST 1 staphylococcus. Growth is completely inhibited in tubes 2, 3, and 4 while tube 1 shows +++ growth. Reading is made as 0.01 cc. of urine contains 0.1 of penicillin.

Summary of Semisolid Method

A test for determining the penicillin sensitivity of bacteria using a semisolid media is described. The penicillin titer of three strains of bacteria were determined to be as follows:

<i>Strain</i>	<i>Penicillin titer</i>
Affi	3.0 units
ST 1	0.1 units
SP	1.0 units

The same technique may be utilized in determining the penicillin content of the body fluids.

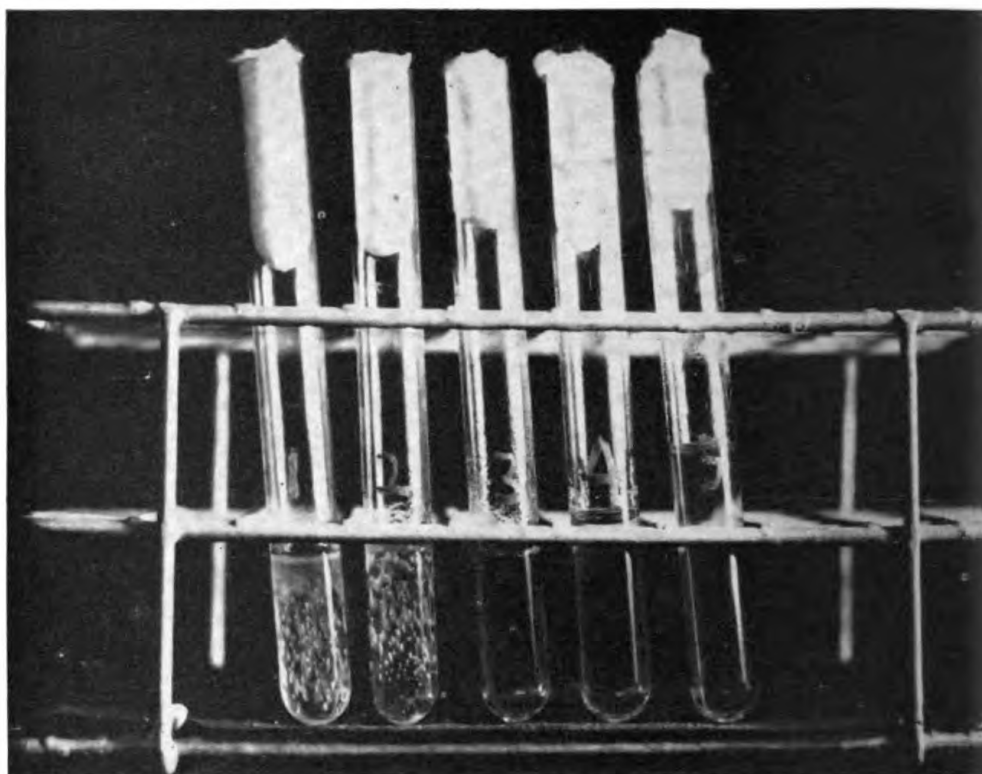


FIGURE 8.—Determination of penicillin in urine. Tube 1 (control tube) contains no urine. Tubes 2, 3, 4, and 5 contain 0.01 cc., 0.1 cc., 0.5 cc. and 1.0 cc. of urine respectively. All tubes were inoculated with ST 1 staphylococcus. Growth is completely inhibited in tubes 3, 4, and 5 while tubes 1 and 2 show +++ growth. Reading is made as 0.1 cc. of urine contains .1 units of penicillin.

REFERENCES

1. Laboratory Tests for Patients Receiving Penicillin Therapy. BuMed News Letter. 4: 7-8, Sept. 1, 1944.
2. WILSON A. T.: Method for testing in vitro resistance of group A hemolytic streptococci to sulfonamides. Proc. Soc. Exper. Biol. and Med. 58: 130-133, Feb. 1945.
3. COOKE, J. V.: Simple clinical method for assay of penicillin in body fluids and for testing of penicillin sensitivity of bacteria. J.A.M.A. 127: 445-449, Feb. 24, 1945.

GANGRENOUS APPENDICES EPIPLOICAE

Report of Two Cases

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The occurrence of inflammation in appendices epiploicae is not a common cause of an acute surgical abdomen. Many surgeons have not seen such cases in their entire career though cases have been reported from time to time in the literature. Its occurrence is undoubtedly more frequent than is suspected or reported and is not reported because removal of the lesion results in quick and undramatic cure. It is felt that the report of such uncommon cases is important in the hope that those who have not seen such a lesion will recognize it and that radical surgery may be prevented when simple removal of the mass effects a cure.

All surgeons are familiar with the appendices epiploicae as they occur along the course of the large intestine from the ascending colon to the lower sigmoid. They are most abundant in the transverse and pelvic colon and may attain considerable size in fat individuals. Christopher¹ states that the cecum as well as the appendix sometimes gives rise to them. They consist of subserous, pedunculated collections of fat and are studded along the anterior and posterior muscular bands respectively. The lesion occurring in them is due most often to torsion with interference of the blood supply and subsequent gangrene. This has caused in rare cases a foreign body in the abdomen or a focus for adhesions for labor intestinal obstruction.

The symptoms and signs of torsion or gangrene of appendices epiploicae are, in short, those of an acute surgical abdomen. The patient usually has a sudden attack of sharp abdominal pain with vomiting, spasm, and tenderness over the affected area. The most characteristic signs of an acute abdomen occur when the inflamed mass lies on the anterior wall of the large bowel and in contact with the parietal peritoneum. The differential diagnosis with acute ap-

¹ CHRISTOPHER, F. (editor) : Textbook of Surgery. 8d edition, revised. W. B. Saunders Company, Philadelphia, 1942. p. 1222.

pendicitis, acute cholecystitis, and diverticulitis may be difficult and the condition can only be established by laparotomy. The most common mistake is in making a diagnosis of acute appendicitis though one can hardly call it a mistake when the signs, symptoms, location, and course may be so similar.

The treatment on discovery is excision. The fatty mass is found enlarged, edematous, and indurated, and may be mistaken for an appendix when the appendage lies low on the ascending colon. The mass may be purplish black which is the later gangrenous stage. It may be surrounded by filmy acute adhesions which can be separated easily with the finger due to their fibrinous nature. In that one is not dealing with an infected lesion and there is no continuity with the intestinal tract, the abdomen may be closed and chemotherapy with sulfonamides or penicillin is not necessary. Convalescence is uneventful as after the usual appendectomy.

CASE REPORTS

Case 1.—A 24-year-old patient was admitted to a naval hospital because of severe pain in the flank and right lower abdomen. The pain had come suddenly 2 days previously, had remained steady and without radiation, and had become slowly more severe. Vomiting had persisted with a slow rise in temperature and pulse. Physical examination revealed the patient acutely tender in the lumbar region and over the middle portion of the right abdomen with spasm and rebound tenderness in this area. No mass could be felt, bowel sounds were normal, and the liver area seemed normal. The WBC was 12,600 and the urine negative. A preoperative diagnosis of acute appendicitis lying superiorly and laterally was made. Laparotomy showed an indurated blackened mass the size of a walnut lying on the antero-lateral upper portion of the ascending colon. It was gently freed of new adhesions and removed after determining that it had no connection with the bowel. The postoperative course was stormy for 4 days in view of considerable ileus but thereafter was uneventful. Microscopic study of the specimen showed an acute inflammatory reaction in fat with multiple large areas of necrosis.

Case 2.—A 20-year old patient was admitted to a naval hospital because of severe pain in the right lower quadrant, nausea, and vomiting. The pain developed 12 hours before admission and had remained localized in the area mentioned. There were no previous like attacks and no associated dysuria or diarrhea. Physical examination revealed marked tenderness, spasm, and rebound tenderness over McBurney's area. Rectal examination was normal as were the WBC and urine. In view of the marked physical signs, a diagnosis of acute appendicitis was made. Laparotomy revealed a sausage-shaped, hard, black mass lying on the anterior wall of the lower ascending colon. It was freed, ligated at the base, removed, and showed no connection with the bowel. The postoperative course was uneventful. Microscopic study of the specimen showed it to consist entirely of fat with a marked acute inflammatory reaction and multiple areas of necrosis.

SUMMARY

Two cases of gangrenous appendices epiploicae are presented, both occurring in the author's experience at a naval hospital. Both cases were diagnosed incorrectly preoperatively as acute appendicitis. The recognition of this surgical pathology will help those who also encounter this unusual condition.

THE RECOVERY OF THE PATIENT
IS THE FIRST CONSIDERATION
OF THE PHYSICIAN—**Hippocrates**

EDITORIALS



NOBEL PRIZE WINNERS

The first award of the Nobel Prize was in 1901 (April 10, the anniversary of the death of Alfred Nobel). April, 1946, marked the 45th year of awards.

A statistical study of the number of recipients of the Nobel Prize in physiology and medicine and in physics and chemistry is of considerable interest. Below is a table giving the nationality of the recipients and the number for each science.

	Physics	Chemistry	Physiology and medi- cine		Physics	Chemistry	Physiology and medi- cine
American	6	3	6	German	12	15	8
Australian	1	2	3	Hungarian	0	0	1
Belgian	0	0	2	Indian	1	0	0
Canadian	0	0	2	Italian	2	0	1
Danish	1	0	3	Russian	0	0	2
Dutch	4	2	2	Spanish	0	0	1
English	10	6	6	Swedish	2	3	1
French	6	6	3	Swiss	1	3	1

It is at once seen from an examination of the table that many of the smaller nations have a relatively large number of those receiving the Nobel Prize. Thus Holland has a total of 8, Sweden has 6, and Switzerland 5. Of the larger nations, Germany leads with a total of 35 followed by Great Britain with 22, followed by France and the United States with 15 each. These numbers are even more striking for both the small and large nations mentioned, if the ratio per 1,000,000 of population is considered.

One can only speculate on the reason for the high ratio among smaller nations and the great difference among larger countries. Facilities for research are available in all of them. The natural bent of national character and the greater encouragement of learning through social rather than financial reward may account in some measure for the differences, but other and unknown factors also probably exist.

The youngest recipient of the Nobel Prize for medicine was Sir Frederick Banting, a Canadian, the co-discoverer of insulin. He was 32. The youngest of all Nobel Prize winners were Paul A. M. Dirac of England and Carl D. Anderson of America, who received the prize for physics at 31 years of age. The oldest recipient was Ferdinand Brissot of France who was 86 years old when he received the Nobel Peace Prize. The oldest American recipient, also of the Peace Prize, was Jane Addams, 74 years of age.

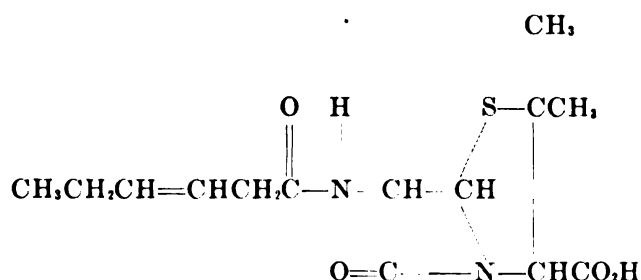
There were only 9 women among the 203 recipients among individuals. Four institutions received the prize.



THE COMPOSITION OF PENICILLIN

In 1943 it was shown that penicillin contained two substances different in chemical structure. They were called Penicillin G and F. Two others, K and X, have since been identified. There are others already known and probably others not yet isolated. The differences in these types are not only chemical. They differ also in therapeutic values and physiological effects.

The basic chemical structure is the same and the differences are found in the side chains. The formula for Penicillin F is an example:



The others G, K, and X, differ only in the side chains.

An interesting feature of the different penicillins is not only that some, such as K, contain a certain amount of inert matter but the fact that there is a specific action against pathogenic agents. It will thus be possible to use the particular type desired or use a penicillin in which the different types are combined in certain proportions to affect certain bacteria. Research on penicillin is full of great promise.



CURARE

The revival of the use of this drug makes a note of its history and action of importance.

The drug was used by certain Indian tribes of South America as an arrow poison and was noted by Europeans during the 16th Century. It is said that Sir Walter Raleigh brought some of it to England in 1595 for investigation as a medicinal agent. Great confusion existed as to the origin, plants of the *Strychnos* and *Chondrodendron* genera being included as well as a number of others. The matter is by no means settled today, but an alkaloid has been isolated from tubocurarine which as d-tubocurarine chloride is the drug now being employed, principally to produce muscular relaxation in surgery, to lessen the force of the seizure in convulsion therapy, and in spastic and athetoid conditions.

The curare action is an interruption of the neuromuscular junction. It is thus antagonistic to acetylcholine. Motor paralysis or merely muscular relaxation is produced varying with the amount of drug. The action is reversible and the paralysis disappears as the curare is eliminated. The danger from the use of curare is considerable. Paralysis of the phrenic nerve may occur and because of the uncertainty as to the origin and assay there is often doubt as to the exact strength of drug employed. For the present, it is certain that it should be used only by the most experienced clinicians. Conservatism in dealing with a drug so powerful and so composite in its origin is necessary if the axiom of Hippocrates which stands at the head of this editorial section is to be followed.



CLINICAL NOTES



YAWS TREATED WITH PENICILLIN

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Commander (MC) U. S. N. R.

It is now well known that penicillin is effective in the treatment of yaws. This disease, prevalent in children, has a high incidence among the natives in the islands of the Pacific and there is definite opportunity to compare the effectiveness of penicillin with that of the arsenicals in its treatment. With injections of arsphenamine at weekly intervals most lesions will disappear after 3 to 4 injections. Although the clinical manifestations of the disease may disappear, the Kahn often remains positive unless adequate treatment is given subsequently. Such a course of treatment consists of 4 weekly injections of bismuth and an arsenical, preferably marpharsen, then 4 weekly injections of the arsenical alone, followed by 8 injections of bismuth at weekly intervals. Recently Lofgren (1) reported a case of yaws treated with penicillin and he found the drug to be rapidly effective and the Kahn negative in 43 days. His plan was to give 20,000 Oxford units of penicillin intravenously, following which the patient was immediately given 15,000 units intramuscularly. Thereafter 15,000 units were given intramuscularly every 3 hours for a total of 1,500,000 units.

CASE REPORT

A native Chamorro, age 13, was admitted to the hospital on 25 April 1945. He had had a generalized eruption on the body with large ulcerated areas on his legs for about 4 weeks. His general health was good and, except for the eruption, he had no other complaints.

Physical examination revealed a generalized erythematous, papular, and pustular eruption involving the extremities, face, trunk, scalp, hands and feet. The eruption showed a marked resemblance to variola. There were large granulomatous ulcerated lesions on both shins. The one on the right shin was about the size of a half dollar. Some of the lesions were oozing (fig. 1). Except for some cervical, axillary, and inguinal adenopathy and a soft systolic murmur at the apex of the heart, the remainder of the examination was essentially negative. Darkfield examination of serum from the lesion on the shin revealed spirochetes which were morphologically typical of *Treponema pertenue*. The Kahn blood test was 3 plus. The urine examination showed a faint trace of albumin and



FIGURE 1.

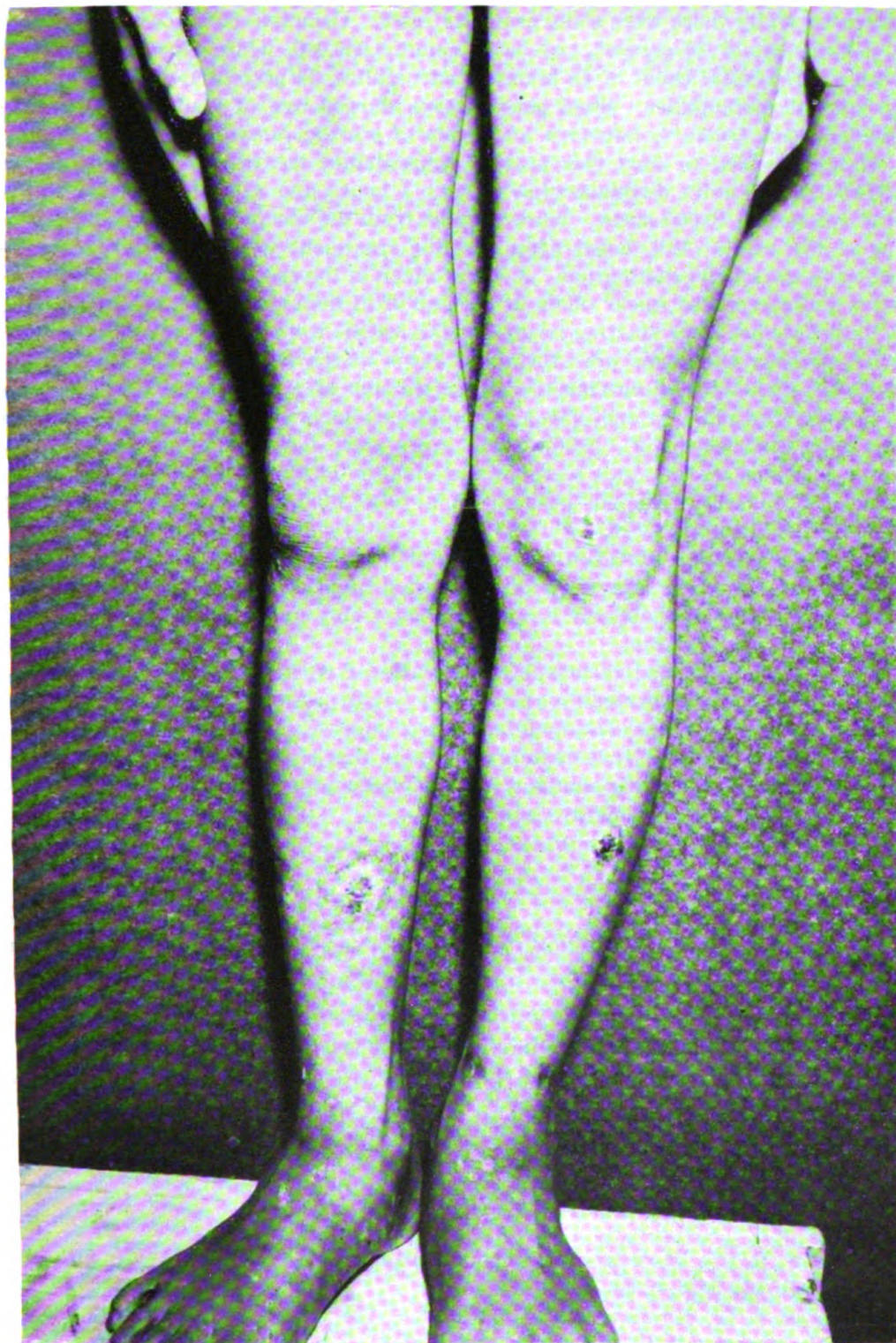


FIGURE 2.

microscopically there were some granular casts. Complete blood count revealed a hemoglobin of 70 percent, red blood count 3,640,000, white blood cells 7,950, with a differential count of 48 percent neutrophils, 34 percent lymphocytes and 18 percent eosinophils. Stool examination showed ova of hookworm, *ascaris lumbricoides*, *trichuris trichiura* and cysts of *giardia lamblia*.

It was decided to start this patient on penicillin treatment. He was given 15,000 Oxford units intramuscularly every 3 hours and after 8 days, the dose was dropped to 10,000 units. Smears taken from the ulcerated area on his right leg at 3½, and at 18½ hours after starting treatment were positive for spirochetes by darkfield examination. A smear taken at the end of 27½ hours was negative and a repeated smear taken at the end of 51 hours still remained negative. Within 48 hours after starting treatment the lesions were drying up. There was some crusting and scabs were forming. Some of the lesions on his face began to disappear. A blood specimen taken at the end of 4 days showed a two plus Kahn reaction. At the end of 5 days the lesions on the face had cleared up and the scabs had fallen off. No pustular areas were noted. The large granulomatous lesions on his shins were getting smaller although the ulcerated areas were still present. He had been given a total of 1,490,000 Oxford units of penicillin in about 15 days.

A photograph (fig. 2) taken 19 days after starting treatment with penicillin showed the secondary lesions to have almost disappeared while the large ulcerated lesions showed scabs. A Kahn taken on 4 May and again on 23 May still showed a 2 plus reaction.

The lesions responded remarkably to treatment with penicillin at the beginning but did not heal as rapidly as expected. It is possible that a more effective response might have been obtained had larger doses of penicillin been given in a shorter period of time. It is of interest to note that the Kahn reaction was still positive 2 weeks after treatment was stopped, although not as strong as on admission. Further observations are necessary.

CONCLUSION

It is the author's conclusion that in this case penicillin caused a more rapid resolution of the lesions in the early stages of treatment, but that the length of time necessary for the complete disappearance of the lesions is about the same for both types of treatment.

The use of penicillin in the treatment of yaws offers considerable promise but more work needs to be done to determine its eventual effectiveness.

REFERENCES

1. LOFGREN, R. C.: Yaws treated with penicillin; report of case. U. S. Nav. M. Bull. 43: 1025-1030, Nov. 1944.
2. LEFEVRE, I. D., J.: McDERMOTT, K. F., and VENNEN, R. B.: Yaws survey on Nanumea atoll, U. S. Nav. Bull. 43: 739-741, Oct. 1944.
3. ANDREWS, G. C.: Diseases of the Skin. 2nd edition. W. B. Saunders Company, Philadelphia, Pa., 1938. p. 821.

GUNSHOT WOUND OF THE THORACIC DUCT

WITH REPORT OF A CASE

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and

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The thoracic duct is so situated that specific injury to it alone, without involvement of other vital nearby structures, is undoubtedly rare. Injury to the duct alone occurs occasionally during surgical neck dissections,¹ but for a bullet to select it from among so many vital structures in the mediastinum must be unusual and bizarre. This and the rather unusual clinical course of the casualty who suffered this wound suffice to make the case one of more than ordinary interest, especially since an autopsy permitted an adequate reconstruction of the injury.

CASE REPORT

A corporal, U. S. M. C. R., age 28, suffered a gunshot wound through the thorax on 12 March 1945. He was immediately evacuated to an advance base hospital where the wound of entrance was described as being between the second and third ribs just to the right of the right sternal margin, and the wound of exit lateral to the costovertebral junctions of the left fifth and sixth ribs posteriorly. In other words, the bullet had traversed the mediastinum from right to left and a little downward.

X-ray examination disclosed a fracture of the base of the left fifth and sixth ribs and the presence of fluid in the left pleural cavity. Twelve hundred cc. of air and 250 cc. of blood were removed by thoracentesis and the patient did well until 31 March when he developed severe diarrhea, nausea and vomiting. Stools were examined for culture and parasites and although nothing was found, his symptoms were such that a course of emetine was administered.

He was evacuated from advance base by ship leaving on 15 April, at which time his chest wound had healed but he showed a marked degree of emaciation and dehydration. His temperature was normal but pulse rapid and weak. His tongue was dry and coated and color pale. No abnormalities were noticed in his chest but there was a definite abdominal fluid wave present and it was judged that he had 500 to 1,000 cc. of fluid in his peritoneal cavity. Moderate ankle edema was present. Laboratory findings at that time were as follows: RBC: 4,360,000; Hgb.: 90 percent; WBC: 17,650; segs.: 92; lymphocytes: 8; plasma protein (CuSO₄, sp. gr. method) 4.2; urine: sp. gr. 1.016, pH 6.5, albumin one plus, sugar 0, occasional WBC microscopically.

Attempts at fluid replacement were made, giving 2 units of human albumin and 2,000 to 3,000 cc. of 5 percent dextrose and saline intravenously daily, and full fluids by mouth. It was hoped that his plasma proteins could be brought up

¹ BARNES, H. A.: Scalenus anticus syndrome, with reference to injuries of thoracic duct; report of a case. U. S. Nav. M. Bull. 44: 773-776, April 1945.

to normal and his dehydration corrected but this was only partially and temporarily accomplished.

Although he ate and drank voraciously he vomited frequently and the severe diarrhea which he had had in the hospital persisted unchecked.

On 18 April an abdominal paracentesis was carried out and 10 cc. of a thin, pale white fluid were removed. The peculiarity of the fluid was such that it was decided that no more should be removed without an examination of the specimen. This was done and the fluid was found to be a fatty emulsion that was obviously chyle. It was also observed that he occasionally vomited fluid which appeared chylous.

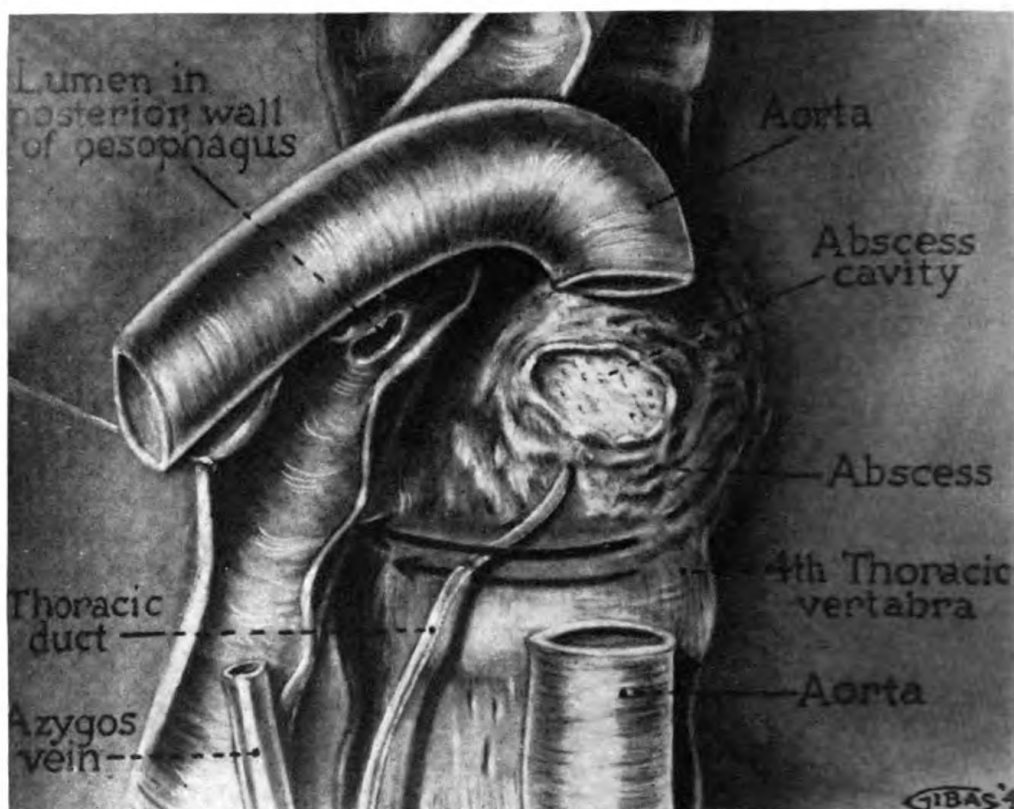


FIGURE 1.—Drawing showing abscess on ventral surface of fourth thoracic vertebra. The thoracic duct is shown entering the wall of the abscess. The esophagus has been retracted laterally as indicated by arrow and hook. The lumen in the posterior wall of the esophagus was directly over the abscess cavity and is the hiatus through which chyle escaped into the esophagus.

In spite of all attempts to feed him intravenously, including repeated transfusions, the patient rapidly deteriorated and died on 24 April, 43 days after his original wound. The cause of death was stated to be obstruction of the thoracic duct following a gunshot wound and subsequent inanition.

Autopsy Report

The autopsy was performed by Commander O. A. Brines (MC) U. S. N. R. A condensed report containing pertinent details follows:

Inspection.—The body is that of a markedly emaciated young white male. There is an oval-shaped perforation of the skin measuring 3 by 2 cm. near the inferior angle of the scapula. A scar is present over the second interspace at the

right of the sternum which apparently represents a fairly well healed bullet wound.

Abdomen.—The peritoneal cavity contains 150 cc. of turbid bloody fluid. No solid fecal material is present.

Thorax.—Throughout the left pleural cavity there are firm but easily separated adhesions except about the site of the bullet wound through the posterior chest wall where the adhesions are especially dense and where there is fibrous thickening of the pleura. There is a complete fracture of the sixth rib on the left side in the mid-scapular line and there is also splintering of the fifth rib in the same plane. There is splintering of the medial border of the left scapula near the inferior angle. Throughout the right pleural cavity there are adhesions which are less numerous but more dense than those in the left pleural cavity. There is no appreciable amount of fluid or blood in either pleural cavity. There is splintering of the anterior left lateral aspect of the body of the fourth thoracic vertebra, overlying which there is an abscess 5 cm. in length and 3.5 cm. in maximum width, the cavity of which communicates both with the thoracic duct and the esophagus. There are two perforations of the esophagus, the largest measuring 1 cm. in diameter through which probes can be passed into the abscess cavity. The thoracic duct is traced from the cisterna chyli and a perforation is demonstrated in that portion which lies left of the fourth thoracic vertebra. The pathway of the bullet was apparently between the ascending aorta and the superior vena cava anteriorly and between the descending aorta and the body of the fourth thoracic vertebra posteriorly. A fistula between the esophagus and thoracic duct doubtless exists.

Lung.—The left lung weighs 810 gm. and the right lung 820 gm. There is severe hypostatic congestion of both lungs.

Anatomical Diagnosis

(1) Gunshot wound, chest; (2) inanition; (3) abscess, mediastinal; (4) fistula, between thoracic duct and esophagus; (5) cirrhosis, liver (type undetermined); (6) congestion, hypostatic, both lungs; and (7) pleuritis, adhesive, bilateral.

CONCLUSION

A case is presented of a gunshot wound of the chest wherein the bullet passed through the mediastinum severing the thoracic duct. Formation of an abscess which later eroded into the esophagus forming a thoracic duct-esophageal fistula resulted in subsequent inanition and death. None of the other mediastinal structures was injured.



VARICELLA OF THE CORNEA

WITH REPORT OF A CASE

OTTO E. BILLO

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Involvement of ocular structures by the viruses of the common contagious diseases has long been known, but reports of corneal lesions in chickenpox are relatively few. However, keratitis, with or without ulceration, has been described by several authors (1) (2) (3) (4) (5)

(6). An additional report on keratitis occurring during the course of varicella is herewith presented.

CASE REPORT

A 25-year-old coxswain, U. S. C. G., was admitted to the U. S. Naval Hospital, Portsmouth, Virginia, on March 5, 1945, with a diagnosis of varicella. The onset of his illness occurred 2 days before entry with frontal headache and fever, followed in 24 hours by the appearance of a rash. At the time of appearance of the rash, the patient complained of a feeling of irritation in his left eye which began to tear profusely.

Physical examination revealed a well-developed and well-nourished young white male with temperature 100.2° F., pulse 84, and respirations 20. The skin presented a diffuse papulo-vesicular rash with lesions chiefly over the face and trunk, but also over the extremities. There was considerable blepharospasm and tearing of the left eye, although gross examination of the bulb and conjunctivae was negative. The remainder of the physical examination was normal.

Course in hospital.—The temperature fell on the fourth day and the skin lesions showed an evolution typical of varicella. However, the tearing and blepharospasm in the left eye persisted and became gradually worse. On the sixth day, circumcorneal injection was noted. On the fourteenth day, the patient was seen in the eye clinic and the following report was made: "Left eye: Visual acuity 4/20. There is a well marked ciliary injection. There is a central irregular plaque of exudate about 3.5 mm. across in the superficial stroma of the cornea." The diagnosis was changed to keratitis (complicating varicella) and the patient was transferred to the eye service where a paracentesis was done and where the eye was treated locally with penicillin ointment, atropine and dionin for 8 days. The patient was also given intravenous typhoid vaccine therapy twice weekly for 3 weeks. On this regime the corneal infiltrate began clearing, but only slightly, for at the end of 2 months, the visual acuity was 8/20 and there was a residual irregular central corneal opacity.

DISCUSSION

The varicella virus attacks both ectodermal and mesodermal cells (7). The cornea is derived from both these germinal elements, the corneal epithelium from ectoderm, and the substantia propria from mesoderm. Thus, corneal involvement in the course of chicken pox might be anticipated, yet reports in the literature are relatively few. In explanation of this inconsistency, I am in accord with Rosenbaum (6) that corneal lesions in varicella are more common than is generally believed, and that careful eye examination during the course of the disease would reveal them. The minute transient lesions are overlooked and it is only the more marked lesions giving rise to corneal opacity that are noted and reported open.

I believe that in this case, and in probably most if not all instances, the virus reaches the cornea indirectly from the blood by diffusion from the aqueous humor or from the vascular loops at the limbus. It will be noted that this patient's eye symptoms, as in Wyler's case (5), occurred simultaneously with the appearance of the skin lesions, indi-

cating blood dissemination of the virus. I feel that coincident with the appearance of the patient's skin rash there was also a microscopic bleb upon the surface of the cornea which resulted in the symptoms of corneal irritation; it was not until the fourteenth day that this tiny lesion had progressed far enough to reveal an obvious, grossly visible corneal opacity. The slow progress of the lesion can best be explained, as Pickard (3) suggests, by "the special structure of the cornea, a non-vascular and dense tissue which offers special difficulties to the transit of the virus."

Considering the apparent close relationship between the virus of varicella and that of herpes, there is always the possibility that a supposed varicella lesion of the cornea might be a coincident herpetic corneal lesion.

Prognosis as regards healing of the corneal lesion is good. There may be ultimate impairment of vision, however, depending upon the degree of scarring and its location.

SUMMARY

A lesion of the cornea occurring during the course of varicella is reported. It is thought that corneal lesions occurring during the course of varicella are more common than is generally believed.

REFERENCES

1. TERSON, A.: Lésions oculaires dans la varicelle. *Clin. opht.*, Paris **10**: 192-193, June 10, 1904.
2. OPPENHEIMER, E. H.: Varicelle der Hornhaut. *Deutsche med. Wchnschr.* **31**: 833, May 25, 1905.
3. PICKARD, R.: Varicella of cornea, *Brit. J. Ophth.* **20**: 15-18, Jan. 1936.
4. GRÜTER, W.: Die Aetiologie der Keratitis disciformis. *Ber. ü. d. Versamml. d. deutsch. ophth. Gesellsch.* **48**: 200-211, 1930.
5. WYLER, J. S.: Corneal ulcer produced by varicella, *J. A. M. A.* **68**: 1476, May 19, 1917.
6. ROSENBAUM, H. D.: Varicella and the cornea; case report. *Am. J. Ophth.* **26**: 53-56, Jan. 1943.
7. RIVERS, T. M.: *Filtrable Viruses*. Williams & Wilkins Company, Baltimore, Md., 1928.



HARD ODONTOMA COMPLICATED BY AN IMPACTION

WITH REPORT OF A CASE

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An odontoma is a hard tumor composed of enamel, dentin, cementum, and connective tissue not united to the jaw bone, but separated from it by a capsule of fibrous tissue. According to Thoma (1) any tumor of odontogenic origin comes under the general classification of



FIGURE 1.

odontoma; whereas Kronfeld (2) limits them to tumors of essentially tooth tissues. They can be further complicated by soft tissues of mesenchymal origin or cystic qualities.

The particular case under discussion has been classified as a multiple hard geminated odontoma.

CASE REPORT

The patient was referred from the eye, ear, nose and throat clinic for a routine dental examination for possible impactions or foci of infection.

The chief complaint was pain about the left ear and over the left eye with the appearance of a black spot intermittently before the patient's eyes at a distance described as about 2 feet.

The health record of the patient revealed a mild anxiety with evident introvert qualities. He observed within the last year a separation between the lower right lateral and lower left central teeth. History of previous diseases was limited to measles and influenza. The lower right central incisor never erupted following extraction of the corresponding deciduous central at the age of 6.

Clinical findings.—Upon examination of the lower teeth, the lower right first and second molars and the first bicuspid were missing, on the lower left the bicuspids and first and second molars were missing. There was a depression in the labial surface of the ridge in the area of the lower right central. There was a deep sulcus in the midline of the chin.

Radiographic findings.—X-rays revealed an irregular mass of apparent small tooth structure circumscribed by a capsule and located in the right central area

just a millimeter below the crest of the ridge. The erupting force of the odontoma demonstrated a distal displacement of the approximating teeth (fig. 1). An impacted incisor, the crown of which was lying directly beneath the apices of the right lateral and cuspid with the root directed into the symphysis, was also demonstrated (fig. 2). The x-rays revealed a slight resorption of the apex of the right lateral. There was a definite layer of bone between the odontoma and the impaction. Just distal to the left cuspid was a residual root.



FIGURE 2.

Procedure.—It was decided that upon removal of the existing pathological tissue a midline spontaneous fracture of the mandible was highly probable, and a subsequent splint was designed to maintain the fragments in

position if such complications ensued (fig. 3).

The splint was placed in position, being designed to allow access for the operation and as a precautionary measure against a fracture due to surgical trauma.

Rigid aseptic conditions were carried out. A double mandibular block was given with deep infiltration of the labial and lingual areas of the anterior region. Labial and lingual mucoperiosteal flaps were retracted from cuspid to cuspid. A bulging of the labial plate outlined the extent of the odontoma. The labial plate was removed by means of a chisel and odontoma was enucleated. The approximating lateral and central teeth

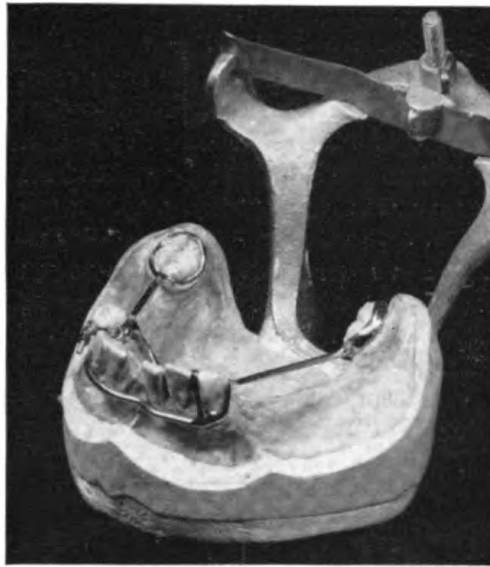


FIGURE 3.

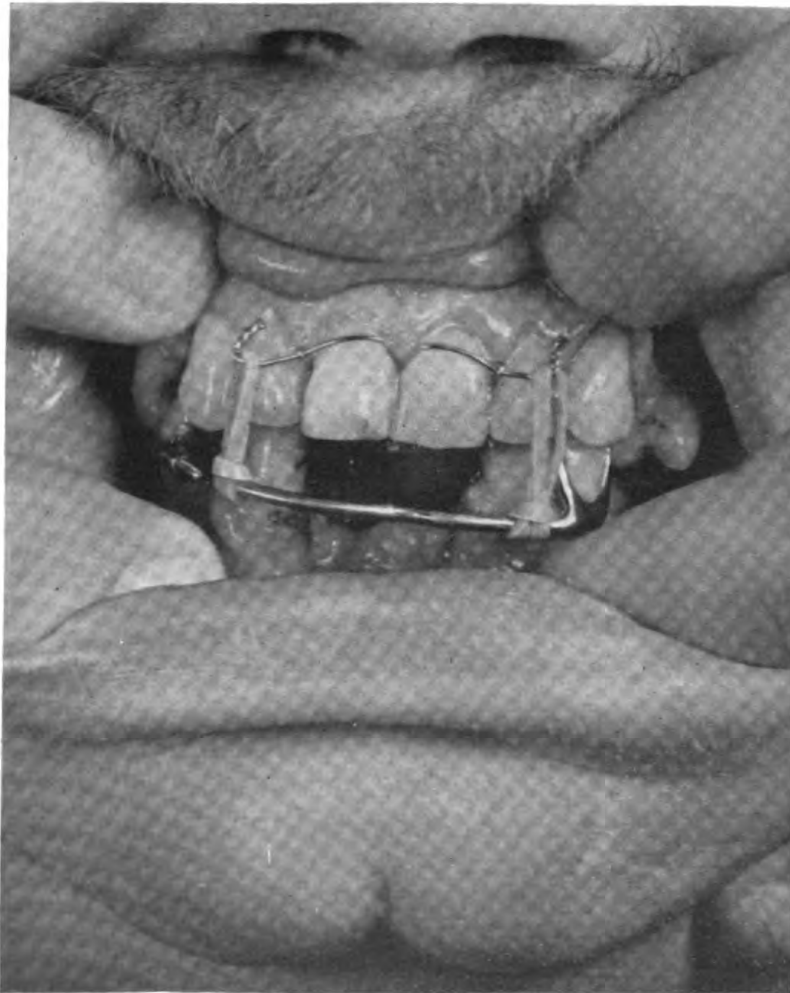


FIGURE 4.

were removed. While exposing the crown of the impaction a caseous material was noted. Further bone was removed and the impaction was carefully teased out; clinging to the body of the root was a large red mass of what appeared to be granulomatous tissue equal in size to the root itself.

Following the removal of all pathological tissue, an iodoform sulfathiazole pack was placed and the tissues sutured and finally the jaws immobilized with splint wires and rubber band (fig. 4).

Clinical pathology.—The odontoma was carefully examined and resembled the size of a large hazel nut. It was completely covered by a fibrous capsule, the contents of which consisted of one well-formed miniature cuspid, a small hard pearl, and a miniature bicuspid geminated to a mass of dentin, cementum, and enamel. The tip of the apex of the impacted incisor was found in the mass of tissue around the root and indicated resorption to the separated portion and the end of the root.

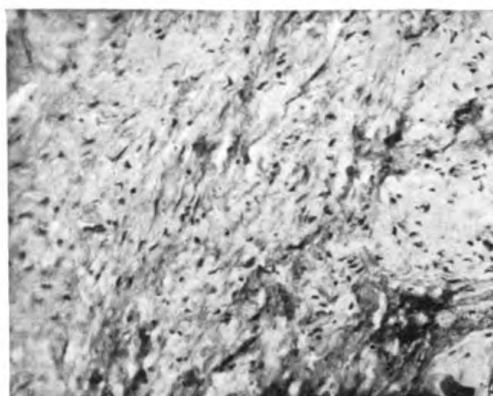


FIGURE 5.—Section of granulomatous mass from impaction under high power magnification.



FIGURE 6.—Section of granulomatous mass from impaction under lower magnification power.

Microscopic findings (figs. 5 and 6).—The section in figure 5 shows compact fibrous tissue which has a border suggesting it is forming a cyst lining. Within a dilated vascular space there is an area of calcification and a tag of transitional epithelium. In the immediate vicinity the connective tissue has a myxomatous appearance, and is absorbing calcium. The tag of tissue in this particular place is not typical of adamantine epithelium, but the change in the character of the connective tissue stroma at this point suggests a relationship to ameloblasts on the part of these cells. (3).

DISCUSSION

(Commander J. E. Muslow (MC) U. S. N. R.)

The foregoing report illustrates a typical condition which has been encountered in many patients with tri-facial neuralgia caused by obscure impactions and infections of the teeth. The complaint in this particular patient was a transient lightning-like radiating pain about the left ear and extending over the left eye and "spots" before his eyes. Close cooperation of the otologist and dental surgeon is of great importance in alleviating the symptoms described and in keeping men fit for military service.

RESULTS:

The patient was relieved of all symptoms and is to be rehabilitated with an appropriate partial plate.

REFERENCES

1. THOMA, K. H.: Oral Pathology. 2d edition. The C. V. Mosby Company, St. Louis, 1944. p. 958.
2. KRONFELD, R.: Histopathology of the Teeth and Their Surrounding Structures. 2d edition, revised. Lea & Febiger, Philadelphia, 1939, p. 477.
3. GESCHICKTER, C. F.: Pathological Report.



HYDRONEPHROSIS SIMULATING PEPTIC ULCER

WITH REPORT OF A CASE

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Captain (MC) U. S. N.

and

JAMES T. MASON, JR.

Commander (MC) U. S. N. R.

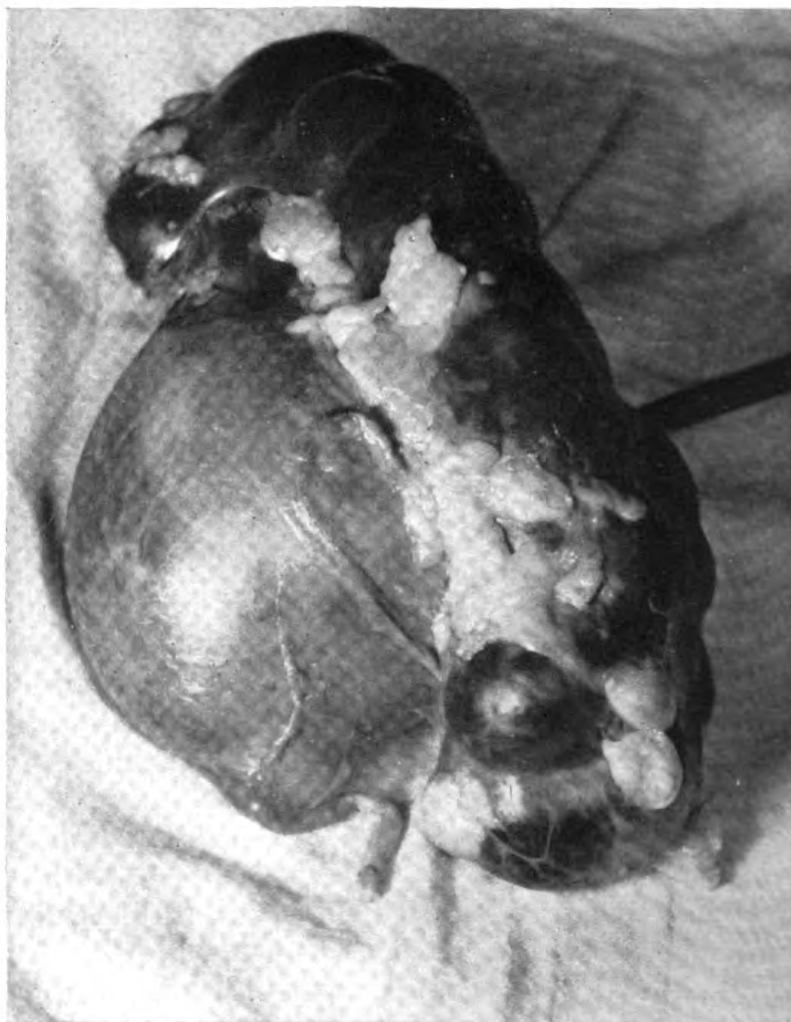
Hydronephrosis is defined as a dilatation of the renal pelvis and calices from an obstruction to the outflow of urine. The obstruction may be congenital or acquired and may be further subdivided into the open, closed, or intermittent type. Some of the usual causes of obstruction are strictures, aberrant vessels, bands, angulation of the ureter, valves, neurogenic dysfunction of the pelvo-ureteral musculature, anomalous insertions of the ureter, stones, and tumors either extra- or intra-urinary.

The symptoms presented by the individual case are dependent upon the type and cause of the obstruction. There may be pain, hematuria, intermittent polyuria, or a complete absence of symptoms with the patient complaining only of a mass in the abdomen. In certain cases there may be gastro-intestinal symptoms of a varied nature. The cause of those symptoms may be direct pressure on the stomach and duodenum or tension on the coeliac plexus from the large retroperitoneal mass.

We are presenting this case of the congenital, open type of hydronephrosis to re-emphasize the importance of the gastro-intestinal symptoms. These may be, as in this case, the only manifestations of an otherwise asymptomatic hydronephrosis.

CASE REPORT

A 29-year old chief pharmacist's mate was admitted in this hospital ship 19 October 1945, with a chief complaint of epigastric pain dating back to June 1943. The pain was described as a constant dull ache in the left hypochondrium, with acute exacerbations. These were knife-like, non-radiating, and occurred every 4 to 6 weeks, lasting from a few days to a week. All meals increased the pain, giving the patient what he described as a "stuffed feeling." Even in the most severe attacks, abstinence from food or a light diet gave some relief which was



This photograph reveals the large extra-renal pelvis of the removed hydronephrotic kidney. The angulation of the upper ureter as shown was the only obstruction demonstrable.

not afforded by any medication. After eating, the severity of the pain was inaugurated by standing after which posture had no effect. The patient had not noticed melena, hematuria, left lumbar pain, or passage of a urinary calculus. The patient was not hospitalized at that time but was told that he had an enlarged spleen due probably to malaria which he had had in April of that year.

In November of 1944 a GI series was done which showed a deformity of the duodenal cap but which did not demonstrate a duodenal ulcer crater. On a light

ulcer diet the symptoms subsided and the patient was discharged to duty in January 1945.

In September of 1945 the patient again reported to his medical officer complaining of constant pain in the left upper abdomen, aggravated by eating and not relieved by drugs. Physical examination revealed deep epigastric tenderness and a large, smooth, freely movable mass, ovoid in shape ($3\frac{1}{2}$ inches by 6 inches) located in the left upper quadrant. A GI series showed the duodenum to be normal and a large extrinsic tumor mass filling the entire left side of the abdomen, displacing the small intestine to the right. Intravenous urograms showed a normal right kidney and no dye excreted by the left kidney. A left retrograde pyelogram showed a massive hydronephrosis. There was a large extrarenal pelvis and a sharp uretero-pelvic angulation of an otherwise normal left ureter.

A left nephrectomy was done removing a greatly dilated kidney from which 1,040 cc. of urine were aspirated. The parenchyma was a mere shell. The upper ureter was found adherent to the extremely dilated pelvis giving the angulation described. There were no aberrant vessels or bands apparent. On straightening the angulation the outflow through the uretero-pelvic junction was free.

The postoperative course was uneventful. There has been no epigastric discomfort or other symptoms referable to the GI tract since operation. A GI series done since operation is reported to be negative.



PTERYGOMANDIBULAR ABSCESS CONFUSED WITH ACUTE PERITONSILLAR ABSCESS

WITH REPORT OF A CASE

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and

MITCHELL M. TANNER

Lieutenant Commander (DC) U. S. N. R.

An enlisted member of the Women's Reserve reported to the station on 12 June 1945. While being routinely checked through our station dispensary, she complained of sore throat and considerable difficulty in swallowing. Temperature was 100.2° F. Examination of the pharynx revealed marked swelling and injection of the right anterior pillar of the fauces (palato-glossal fold) with some edema and displacement of the uvula to the opposite side. The tonsils were surgically absent. The remainder of the physical examination was essentially negative.

CASE REPORT

The patient was admitted to the WAVE'S ward with diagnosis of peritonsillar abscess acute, right, and treatment consisting of sulfonamides and hot saline irrigations was instituted.

On further questioning following admission, it was learned that one month prior to the onset of her present condition, the lower right wisdom tooth was extracted because of horizontal impaction. The extraction was quite difficult, and entailed considerable manipulation. She visited the dental officer on several occasions following this procedure, and was finally discharged 1 week later with the socket completely healed.

There was no improvement in symptoms under conservative regimen. There was some lateral extension of the abscess involving the pterygoid muscles, giving rise to trismus. Dysphagia became more marked, with considerable involuntary drooling resulting therefrom. Pain was referred toward the ear on the affected side.

The following day a dental consultation was held. It was felt that because of the earlier dental procedure, and the surgically absent tonsils, the etiology of this abscess resulted from either retained tooth fragments or an osteomyelitic process. X-rays of the lower right molar area revealed no pathology. There was a normal deposition of fibrous connective tissue in the alveolar socket. Clinically, the muco-periosteum in the questionable site was well healed in tonicity and appearance.

On rounds the next day, there was some subjective improvement. Clinically, there was noted a changed picture. The abscess on the anterior pillar was now more circumscribed and fluctuant. In the right pterygomandibular space appeared a small fistulous opening. Finger pressure over the now fluctuant anterior pillar abscess evoked a sanguino-purulent discharge. Under local anesthesia, a probe was introduced thru the fistulous opening to the depth of the abscess in the anterior pillar. An incision was made directly over the path of the probe. Copious purulent discharge ensued, followed immediately by two particles of tooth structure measuring 3 mm. by 1 mm. The abscess was completely evacuated, and then lightly packed with a 5 percent iodoform gauze drain. On the following day, the drain became loose and was removed, containing another tooth particle. Healing and complete recovery was thereupon rapid and uneventful.

SUMMARY AND CONCLUSIONS

1. This case has been of considerable interest because of the unusual etiology for an abscess involving the anterior tonsillar pillar.
2. It is felt that several tooth fragments had been dislodged during instrumentation and became embedded in the right pterygomandibular fossa.
3. It emphasizes more strongly the continued need to bear in mind the possibility of dental pathosis simulating other conditions.



OSTEOCHONDROMATOSIS

HERBERT C. FETT

Captain (MC) U. S. N. R.

and

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Lieutenant Commander (MC) U. S. N. R.

Although osteochondromatosis is not a rare disease and the elbow joint is second only to the knee in frequency of occurrence, cases with tremendous numbers of joint mice are unusual. This is the report of a case in which 201 joint mice were removed from the left elbow.

CASE REPORT

The patient was a 27-year-old, white seaman, second class, who gave a definite history of injury to his elbow 6 years previously, while playing football. He did not know whether or not there had been a fracture and the only treatment consisted of carrying his arm in a sling for 2 weeks. He never regained full extension of the arm but he claimed that other motions were not limited and the arm was painless. His health record contained no mention of disability on his induction, 11 May 1944 or on 21 June 1944 when he was hospitalized for angioneurotic edema.

He was admitted to the hospital on 18 May 1945, complaining of pain and limitation of motion of the left elbow which had persisted since an accident on board ship 2 weeks previously when his elbow was caught between a 20 mm. gun

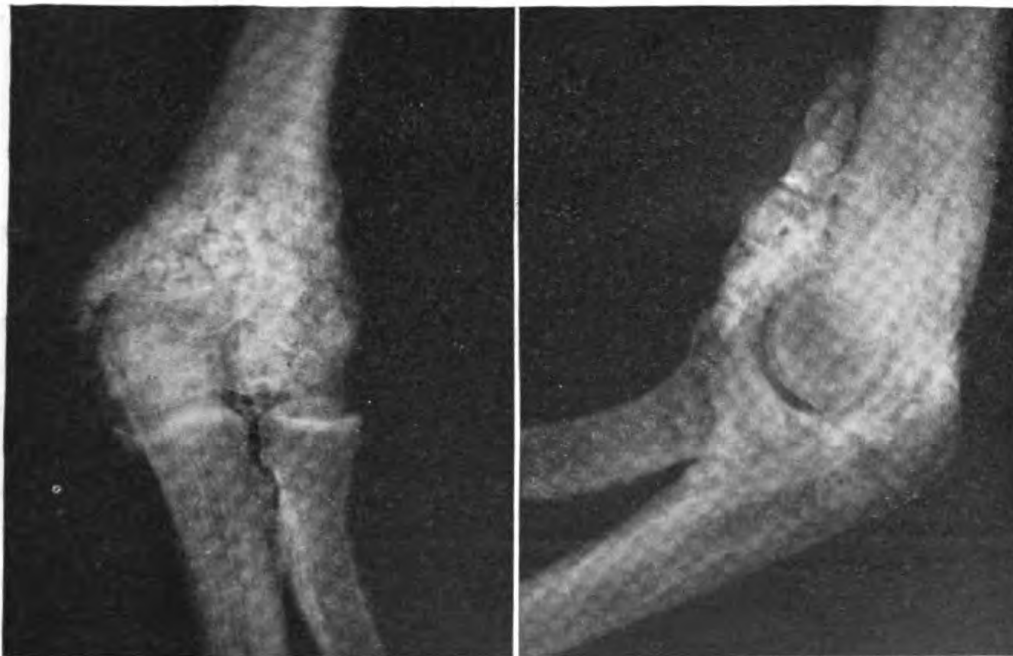


FIGURE 1.—Preoperative x-ray view of left elbow. Note multiple osteochondromas (joint mice) surrounding joint.

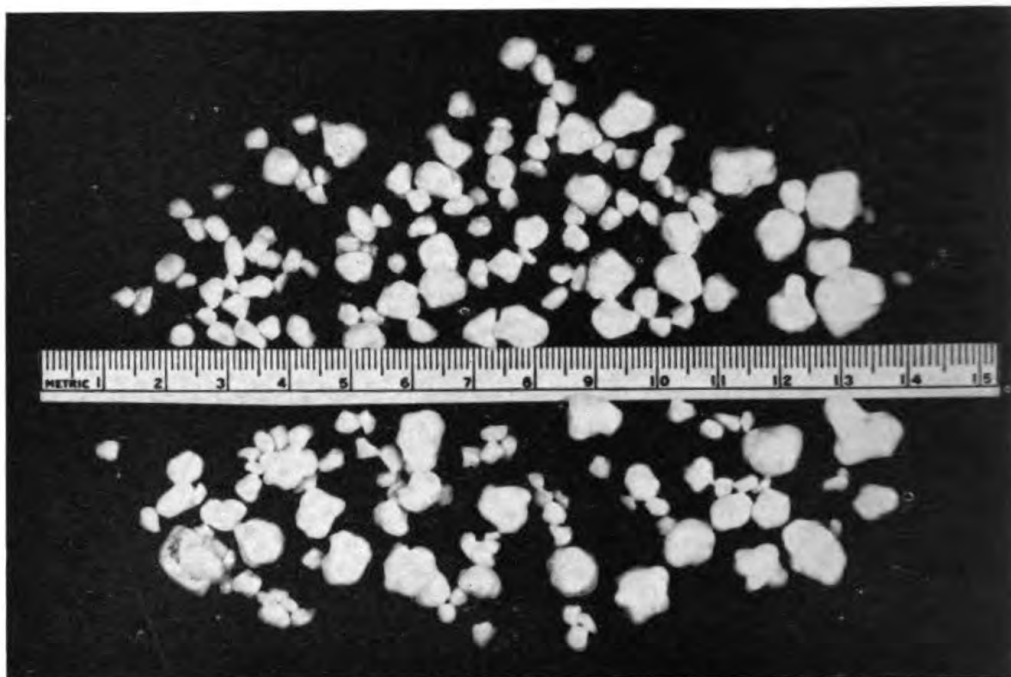


FIGURE 2.—Photograph of multiple bodies removed from area of left elbow.



FIGURE 3.—Postoperative x-ray view of left elbow. All but 6 osteochondromas have been removed.

and a bulkhead. Physical examination revealed considerable limitation of motion, as well as crepitus in the joint. The range of flexion and extension was only from 110° to 135° . Supination was almost full but there was no pronation beyond the neutral position. X-ray examination revealed multiple osteochondromas extending completely around the elbow joint.

On 25 May 1945 operation was performed. The joint was entered by a medial incision, an osteotomy of the medial epicondyle was done, and the fragment together with the flexor muscles was reflected distally, affording an excellent exposure for removal of the bodies. All joint mice which could be found were removed by scooping them out and by irrigation. Many were attached to the synovial membrane by thin pedicles and had to be individually located and excised.

While the wound was open, portable x-ray films were taken to determine whether or not all the loose bodies had been removed. The films revealed that 6 joint mice were still present within the joint and these were located and removed prior to closure of the wound. The incision was closed by suturing the medial epicondyle in position and the arm was maintained at 90° flexion for 3 weeks. Convalescence was uneventful.

COMMENT

Although postoperative roentgenograms showed that not all the joint mice were removed, the patient now has painless motion from 60° to 160° , with full pronation and supination.

BOOK NOTICES



Publishers submitting books for review are requested to address them as follows:

The Editor,

UNITED STATES NAVAL MEDICAL BULLETIN,

Bureau of Medicine and Surgery, Navy Department,

Washington 25, D. C.

(For review)

CLINICAL RADIOLOGY, in 2 volumes, by 58 contributors; edited by *Captain George U. Pillmore, (MC) USNR*. 1,558 pages; 2,484 illustrations on 1,500 figures. F. A. Davis Company, Philadelphia, Pa., publishers, 1946. Price \$45.

There are 58 contributors to these two volumes. A work of such composite authorship can be very good or very bad depending on the selection of the contributors and the ability of the editor. That this book is an outstanding treatise on radiology testifies to both the excellence of authors and editor.

The two fine volumes are more than a textbook. They constitute an atlas of radiology with hundreds of magnificent illustrations showing the radiographic pictures of both normal and pathological structures. The clearness of the pictures and the excellence of the descriptions that accompany them give this work exceptional value to the clinician and the radiologist.

It is this relationship of the x-ray findings with the clinical findings that are constantly emphasized throughout. Furthermore as the Surgeon General of the Navy, Vice Admiral McIntire states in his foreword, "There is perhaps less isolationism in the field of radiology than in any other branch of medicine. It is this feature of the interrelation of radiology with the other clinical specialties that is particularly noteworthy in this work."

It is natural too that a book on radiology published at this time should embody in it all the new experience gained in World War II. The fact that so many of the contributors as well as the editor had active service in the armed forces is an assurance that this side of the subject has received much attention. The localization of foreign bodies is well and fully described.

There is a magnificent chapter on normal bone growth which furnishes a solid foundation for the sections on the osseous changes in

nutritional, endocrine, and toxic conditions. There is a fine section on bone tumors. The chapters relating to the respiratory, cardiovascular, gastro-intestinal, and genito-urinary systems are very complete, the characteristic roentgenographic findings being given in much detail. The obstetrical and gynecological field is also well described.

No radiological or radium treatment is included, the work being confined to descriptive and diagnostic radiology. Operational technique is also omitted. As a text and atlas of diagnostic radiology, however, it cannot be surpassed.

THE DIAGNOSTIC EXAMINATION OF THE EYE by *Conrad Berens, M. D., F. A. C. S., Professor of Ophthalmology, New York University, New York, Professor of Clinical Ophthalmology, Columbia University, New York; and Joshua Zuckerman, M. D., C. M., F. A. C. S., Assistant in Ophthalmology, New York University, Ophthalmic Surgeon, Midtown Hospital, New York.* 711 pages illustrated. J. P. Lippincott Company, Philadelphia, Pa., publishers, 1946. Price \$15.

This textbook discusses in detail a systematic procedure for examining the eye. Not a single method is omitted in the multitude of various ocular examinations. Because of this feature this textbook is invaluable to the resident physician in ophthalmology and candidates studying for the American Board of Ophthalmology. Any practitioner as well will find in this textbook the technique for conducting any type of eye examination and instructions as to how to interpret findings.

There are three parts to this textbook. Part I deals with the examination, which is conducted on the patient's first visit to the office. This embraces such topics as general and special interrogations of the patient with points on how to evaluate headaches, pain and visual faults with possible diagnosis. Other topics in this part are auscultation of the eye, how to test for visual acuity, tonometry with discussion of the various instruments, biomicroscopy, ophthalmoscopy, confrontation testing, motor functions, transillumination, contact illumination, retinoscopy and palpation.

Part II deals with the patient's second office visit. This includes the post-cycloplegic test, testing for color vision, fusion and depth perception, light sense, and perimetry, and special tests such as bacteriologic, etc. In testing for light sense only rapid clinical methods are described and no mention is made of testing rod function accurately as is done with the Radium Plaque Adaptometer used in the U. S. Navy.

Part III gives information relating to the eye qualifications in the armed services including special testing for aviation. Much valuable information is given in this part on the medico-legal aspects of eye injuries and methods are discussed for computing visual efficiencies. All the tests for detecting malingering are given. Of

special interest is the description of the many eye instruments, such as the Brailart Ophthalmodynamometer, the various exophthalmometers, synoptophore, Clason acuity meter, giant binocular ophthalmoscope, lensometer, distometer, keratometer, ergograph and other instruments. Instructions are given as to how to use them. An excellent discussion on contact lenses is given. Part III is a source of ready reference on ophthalmic instruments and this alone should commend itself to the practicing ophthalmologist.

QUICK REFERENCE BOOK FOR MEDICINE AND SURGERY by *George E. Rehberger, A. B., M. D.* 13th edition, 1461 pages; 394 illustrations, 50 plates in color. J. B. Lippincott Company, Philadelphia, Pa., publishers, 1946. Price \$15.

If I were a modern Robinson Crusoe with only one medical book to be saved for my library this would be the volume I would want. It has all the essentials. There are eleven sections. The largest is on general medicine and surgery which take up nearly half the volume. Then there are smaller sections on gynecology, genito-urinary diseases, obstetrics, skin diseases, and orthopedics. In what really amounts to a large appendix is an alphabetical list of drugs, dosage, methods of administration, and action. There is an extensive index so that ready reference is available on any subject. All the new drugs are included. The sections on obstetrics, skin, and eye, ear, nose, and throat have been entirely rewritten and all parts of the book revised and brought up-to-date.

It is the type of book that should be in the desk of every busy general practitioner and furnishes a quick check of a symptom or a dosage. The printing and illustrations are excellent and the color plates a feature of great value.

THE MODERN TREATMENT OF DIABETES MELLITUS by *William S. Collens, B. S., M. D., Chief of the Diabetic Clinic, Chief of the Clinic for Peripheral Vascular Diseases, and Associate Visiting Physician, Israel Zion Hospital, Brooklyn; Associate Visiting Physician, Greenpoint Hospital, Brooklyn; Attending Metabolist, Jewish Sanitarium and Hospital for Chronic Diseases, Brooklyn, N. Y.; Consultant in Metabolic Diseases, Rockaway Beach Hospital, New York; and Louis C. Boas, A. B., M. D., Assistant in Diabetic Clinic and Assistant in the Clinic for Peripheral Vascular Diseases, Israel Zion Hospital, Brooklyn; Chief of the Diabetic Clinic and Assistant Physician, Greenpoint Hospital, Brooklyn; Associate in Department of Metabolism, Jewish Sanitarium and Hospital for Chronic Diseases, Brooklyn N. Y.* 514 pages; illustrated, Charles C Thomas, Springfield, Ill., publishers, 1946. Price \$8.50.

A picture of Aretaeus the Cappadocian who gave the name diabetes to this disease appropriately forms the frontispiece of this useful book by the Chief of the Diabetic Clinic of Israel Zion Hospital, Brooklyn, and his assistant. This work is written to be of aid to the general practitioner in dealing with diabetic patients. The management of the patient, the proper formulae and diets, and the use of insulin are

included. In a pocket in the book is a mean or diet calculator constructed on the slide rule plan, an unusual and practical feature.

The instructions to be given the patient are also excellent and include a clear description of the technique in the taking of insulin so that the patient can carry out this procedure with confidence and safety. Diagrams and illustrations are numerous and apt.

MEDICAL SERVICES BY GOVERNMENT by *Berhard J. Stern, Ph. D.* 208 pages. The Commonwealth Fund, New York, publishers, 1946. Price \$1.50.

The author in presenting this book, calls it "an inventory of medical services," and has gathered together in a monograph of two hundred pages, much information of past and present medical care under the Federal, State, and Municipal Governments. Much valuable information is presented for those interested in the subject of governmental administration and control of medicine. One inaccuracy with which the reviewer is familiar, is the reference to the Health Department of the District of Columbia being federally financed. This is not really the case, as the total Federal contribution to the cost of running all activities of the District of Columbia is only a part of the annual budget, the rest of the money arising from taxes paid by the local residents. The recommendations for expenditures arise in the local government, and do not represent Federal policy. This city has provided free medical care to the indigent with full and part-time physicians for over 30 years.

THE DIAGNOSIS OF NERVOUS DISEASES by *Sir James Purves-Stewart, K. C. M. G., C. B., M. D. Edin., F. R. C. P., Consulting Physician to Westminster Hospital, to the West End Hospital for Nervous Diseases, and to the Royal National Orthopaedic Hospital.* 9th edition. 880 pages, illustrated. The Williams and Wilkins Company, Baltimore, Md., publishers, 1945. Price \$11.

This is a new edition of a standard and splendid book. Excellence in arrangement and style are features of this work. Like any other professional book it has its strong and its weak parts but few are more uniformly good than this one. Particularly fine is the treatment of hysteria in all its phases, a condition which, like syphilis in internal medicine, is always in the mind of the neurologist.

On page 607 is a description of the human personality and what constitutes the normal and what the abnormal which should be a classic of neurological literature. Indeed the whole book is full of enlightening material on mental and nervous diseases of the greatest value to both the general practitioner and the specialist in understanding mental ills.

The sections devoted to the reflexes and the vegetative nervous systems are also exceptional in merit, the description being clear and concise. Throughout this book the emphasis is on the description

and diagnostic feature of disease and the treatment is given rather small space. The illustrations are numerous and excellent. No doctor needs to seek farther for an excellent manual of neurology.

ALLERGY by *Erich Urbach, M. D., Chief of Allergy Department, Jewish Hospital, Philadelphia; Associate in Dermatology, University of Pennsylvania School of Medicine; Member, Board of Regents, American College of Allergists; and Philip M. Gottlieb, M. D., Associate in Allergy Department, Jewish Hospital, Philadelphia; Instructor in Medicine, University of Pennsylvania School of Medicine; Fellow, American College of Allergists.* 2nd edition, 968 pages; numerous illustrations. Grune & Stratton, Inc., New York, N. Y., publishers, 1946. Price \$12.

Complete and up-to-date is the phrase that best describes the new edition of this standard American work. There are many new features. First of all is the printing in two columns which has enabled so large an amount of material to be kept in a one-volume compass. Many older references have been eliminated and those of the last three years added. Although the book is so comprehensive, it is easily used as a manual of the subject, both by the specialist and the general practitioner, due to the arrangement. The whole book has a cross-index presentation in that there are included sections dealing with allergic agents under different groups such as inhalants, ingestants, contactants, and in addition each major anatomic system is covered.

There is a scholarly tone to this book and yet it is extremely practical and usable. It is clear and authoritative. There are many illustrations, all of them excellent. There is an index of subjects and also of authors to whom reference is made.

CLINICAL LABORATORY DIAGNOSIS by *Samuel A. Levinson, M. S., M. D., Ph. D., Director of Laboratories, Research and Educational Hospitals, Chicago, Ill.; Professor of Pathology, University of Illinois College of Medicine; and Robert P. MacFate, Ch. E., M. S., Ph. D., Assistant Director of Laboratories, Research and Educational Hospitals, Assistant Professor of Pathology, University of Illinois College of Medicine.* 3d edition. 971 pages; 207 illustrations, 7 in color. Lea & Febinger, Philadelphia, Pa., publishers, 1946. Price \$10.

This is a very comprehensive manual of clinical pathology. The writers have included many features which made Stitt's book on the same subject so popular, such as a section on parasites, tables on weights of anatomic parts, staining technique, the making of testing solutions, and similar subjects. A desirable feature is a section on the laboratory aspects of legal medicine and toxicology.

The table of the more common bacteria is also excellent and furnishes a compend of cultural and descriptive bacteriology. The laboratory findings in tropical medicine are also a new addition. The laboratory is far more important in the diagnosis of tropical diseases than those of the temperate zone. The failure to recognize that fact is a weakness

of most texts on laboratory medicine and has been corrected in the present edition of this book.

Other new material includes the determination of penicillin content of the blood, and a number of new tests not found in the second edition.

A BIBLIOGRAPHY OF INFANTILE PARALYSIS, 1789-1944, with Selected Abstracts and Annotations, prepared under the direction of the *National Foundation for Infantile Paralysis, Inc.*; edited by *Morris Fishbein, M. D., Editor, Journal of the American Medical Association*; compiled by *Ludvig Kektoen, M. D., Chief Editor, Archives of Pathology*; and *Ella M. Salmonsens, Medical Reference Librarian, John Crerar Library, Chicago*. 672 pages; no illustrations. J. B. Lippincott Company, Philadelphia, Pa., publishers, 1946. Price \$15.

Bibliographies are not light reading but they are like dictionaries, extremely valuable. They are indispensable to the scholar and research worker who can here see what has been done. The first reference in 1789, the year of George Washington's first inauguration, is from Underwood's *Diseases of Children*, and the description of a paralysis in children, which was undoubtedly poliomyelitis, is quoted in its entirety. Of great value is the fact that each reference is briefly abstracted, or in the case of those in foreign languages, at least the title is translated. The work is a monument of research and scholarship.

ILLUSTRATED AVIATION DICTIONARY by *Assen Jordanoff*. 415 pages; 2,000 illustrations. Harper & Brothers, New York, N. Y., publishers, 1946. Price \$3.50.

It is a departure to review any but a medical book in a medical journal but this work would be so useful to flight surgeons and any medical personnel attached to aviation units that a notice of it is demanded.

The book is unique in that it is a pictorial dictionary, an excellent idea for a technical work as too often the words used in definitions are themselves too technical for the uninitiated. The pictures are graphic line drawings intended to give an instant and yet lasting impression. All phases of aviation, including aviation slang, are included.

PREVENTIVE MEDICINE

Captain Otto L. Burton, Medical Corps, United States Navy, in Charge



THE AZYGOS LOBE IN PHOTOFLUOROGRAPHY

WALTER O. PENDLEY

Lieutenant (MC) U. S. N.

Interpreters of radiograms of the chest are sometimes puzzled by peculiar shadows or markings seen in the region of the right upper lung field, but which are somehow felt to be of no pathological significance. These peculiarities may be in the character of lines, localized opacities, differences in radio-translucence of the lung parenchyma, or protrusions from the mediastinal border.

The Tuberculosis Control Section of the Preventive Medicine Division of the Bureau of Medicine and Surgery offers opportunity for the study of large volumes of chest photofluorograms made of U. S. Naval and Marine Corps personnel soon after enlistment, at annual intervals while on active duty, and just prior to separation from the service.¹ Advantage has been taken of this opportunity to devote particular attention to the afore-mentioned shadows in the review of over a quarter of a million photofluorograms, and enough evidence has been accumulated to substantiate the belief of others that they frequently represent aberrant manifestations of the azygos lobe. From the study it is also concluded that occurrence of the azygos lobe, in one form or another, is more frequent than is generally supposed.

Since the 35 mm. photofluorogram is little more or less than the standard 14 by 17 inch roentgenogram in miniature, there is, of course, a very close similarity between the two. Because the peculiar manifestations of the azygos lobe that have been described for the roentgenogram also apply to the photofluorogram, and because the field of photofluorography is a rapidly expanding one, it may be timely to review some of the collected information concerning the anomaly before presenting the results of this more recent photofluorographic study.

¹ The author wishes to express appreciation to Commander Sidney A. Britten (MC) U. S. N. R., Officer in Charge of the Tuberculosis Control Section, Preventive Medicine Division, Bureau of Medicine and Surgery, for his painstaking professional counsel in the preparation of this paper.

HISTORICAL

Attention was first directed to the accessory lobe of the azygos vein, or azygos lobe, by the anatomist Wrisberg in 1778. However, it was not until the advent of the x-ray with its attendant roentgenogram that this anomaly became of general interest. Its classical roentgenographic appearance, with which the medical profession is now familiar, was first described as late as 1923 by Wessler and Jaches who suggested that it might be due to some consistent anatomical variation since its location is always approximately the same. In 1927 Velde offered the suggestion that the shadow is associated with the accessory lobe of the azygos vein and a year later Bendick and Wessler (2) were able to prove conclusively by roentgenographic study and postmortem examination that the peculiarity is due to the anomalous structure of the azygos lobe. Since that time the anomaly has been the subject for fairly numerous reports by observers in the fields of radiography, anatomy, and occasionally that of pathology.

EMBRYOLOGY AND ANATOMY

Underwood and Tattersall (13) have presented some evidence to show that heredity may be an etiological factor in the production of the azygos lobe, and Cunningham calls attention to the constant occurrence of the azygos lobe in certain mammals (10). Cairney (4) and Waterston, as well as Holtby and other observers, affirm that the azygos lobe is a constant finding in the porpoise.

It is generally agreed, however, that the azygos lobe in humans is the result of a developmental phenomenon. It is supposed that the azygos vein, in its course upward from the diaphragm posterior to the lung root, makes an abnormally wide arch before bending forward above the lung root to join the superior vena cava at a level above its usual junction (4). This arch embraces a portion of the undeveloped lung parenchyma which continues to grow toward the apex. The vein therefore cuts a deep fissure into the apical lung parenchyma, and since it is an extra-pleural structure it carries with it into the fissure a layer of visceral as well as parietal pleura, causing a double layer of each to be compressed superiorly by the ascending growth of the divided lung parenchyma. This laminated pleural septum is sometimes called the meso-azygos and is the structure responsible for the curving line of increased density that denotes the presence of an azygos lobe in the radiogram (6).

It is the most mesial portion of the apical lung parenchyma, divided by the meso-azygos, that is known as the azygos lobe. It has no unusual bronchial supply as Geddes (5) and Holtby, as well as Bendick and Wessler (2), have shown by postmortem examination. It

is supplied by the eparterial bronchus which suggests that it is not a primary developmental phenomenon (2). No unique blood supply has been mentioned in any of the several anatomical reports.

RECOGNITION IN THE PHOTOFLUOROGRAM

Generally speaking, the photofluorogram of the chest differs mainly from the standard 14 by 17 inch roentgenogram in that by reason of its size it is somewhat less acute in detail. But in recognition of the azygos lobe this characteristic is more than compensated for by the condensation of structures that is obtained in the smaller film, and many lobes that might otherwise remain hidden are brought out by the customary technique of the photofluorographic method. Moreover, reviewers of photofluorograms have a decided advantage over reviewers of the standard roentgenogram in that they are able to review for comparison a much greater number in any given time. These factors are, of course, a help in the analysis of this particular structure.

A number of observers have pointed out that there is considerable variation of this anomaly even in the roentgenogram and that it may manifest itself in any one of a number of ways.

The classical pattern, the one with which the medical profession is most familiar, is the one described by Velde, Hjelm and Hulten, Wessler and Jaches, and others. This pattern consists of a thin but definite linear shadow which curves downward and medially from the summit of the right apex toward the mediastinum and ends in a plumb-bob, or reversed comma-shaped, density near the second costal cartilage.

Bendick and Wessler also point out that the position of this line is variable, sometimes lying so close to the mediastinum that it is confused with the shadow of the descending vena cava, and sometimes originating so far down on the lateral border of the apex that it appears almost transverse. They state that it is probably a more frequent occurrence than the roentgen examination would indicate because the small azygos lobes near the mediastinum may be obscured by the overlying lung and vena cava, and in other cases it is possible that the fissure itself may not be visible.

Brown and Braverman (3) reported a case in which the azygos lobe, found to be normal in autopsy, appeared as a uniformly dense shadow adjacent to the upper mediastinum instead of the inverted comma-like line alone.

Stibbe (11) classifies or types the azygos lobe on a basis of the position of the fissure as seen in the roentgenogram.

(A) More or less horizontal and cutting the outer or lateral border of the lung at some point between the apex and a position 2 inches below the apex.

(B) More nearly vertical and dividing the apex into lateral halves.

(C) Vertical and cutting off a small tongue-shaped lobe from the inner or mediastinal surface, the pedicle being attached to the upper margin of the lung root.

Analyzing 25 collected cases, Stibbe found that the type was specified in 19, and of the 19, type C comprised 20 percent. Both Cairney and Stibbe believe, however, that a larger series of cases would demonstrate an equal incidence of all three types.

Finally, Nelson and Simon (9) call attention to the fact that normal lung fissures can be seen only in radiograms of the chest in which the incidence of the rays is more or less parallel with the plane of the fissure. It therefore follows that the septum formed by the meso-azygos casts a shadow only for that part of its course that is parallel to the incidence of the rays. They further state that the topography of the vena azygos, which can be seen at the lower end of the linear shadow, exhibits considerable variation, depending upon the depth and position of the fissure. Sometimes it projects well out into the lung field and sometimes it lies close against the side of the mediastinum or appears contiguous with the shadow of the superior vena cava.

In the present study, all of these variations and others besides have been observed. The reversed comma-shaped density of the vena azygos is frequently seen at its usual location but without the long linear shadow curving toward the apex. Conversely, the long curving linear shadow is sometimes present without any definite comma-shaped density at its lower end. Occasionally neither component of this structure can be seen, but instead, a well-demarcated difference in the radio-translucence of the apical parenchyma which leads to a pleural reflection at the summit denotes an azygos lobe. And in some instances the markings of an azygos lobe may so closely resemble normal bronchovascular markings, the lateral angle of the manubrium sterni, projections of mediastinal structures, or hilar nodes that it is identified only after careful study and analysis of these parts.

It is therefore evident that recognition and identity of the azygos lobe is not always simple, and because of its variations it may easily be confused with many conditions, physiological or pathological, found in the right upper lung field of a chest radiogram.

INCIDENCE

Review of the literature in search for the incidence of the azygos lobe reveals no convincing information. A number of series have been collected, but the number of cases considered in any one is so small that it precludes accurate conclusions.

In a tabulation of several such series of roentgenograms by Kayne (6) in 1931, the lowest incidence is given as 0.07 percent for a collection of 8,000, while the highest incidence is given as 0.83 percent for another collection of 120. Mather (8) reports 4 cases in 3,000 roentgenograms while Sparks reports 6 cases in 6,000. Anson and Smith (1) report a concentration of three cases found in the dissection of 68 cadavers, while not a single case was noted in some 630 previous dissections.

Many observers simply state that the occurrence of the condition is obviously rare, but others such as Mackmull (7), Bendick and Wessler, and Cairney state that the incidence is probably greater than is usually supposed. In Mather's and Coope's series of 3,000 cases, 1,372 represented the male chest and 1,628 the female chest. Four azygos lobes were identified in the male group, but none were seen in the female group. However, no conclusions were drawn from these figures as several cases in the female had been reported previously.

In the present study, a preliminary review of approximately 100,000 photofluorograms was made before any tabulations were prepared. This gave a fairly comprehensive acquaintance with the azygos lobe as it is represented in the photofluorogram. Then for the next 150,000 films each occurrence of the anomaly was noted for the records. In the last 25,000 films of the series, an attempt was made to analyze the incidence of the various types according to descriptions already presented.

As stated, the review was made from photofluorograms of U. S. Naval and Marine Corps personnel, the great majority of whom were being separated from the wartime services. This at once presents for consideration the question of selection and the question of possible reduplication.

The presence of an azygos lobe has at no time been a disqualifying defect for entrance into the services. It is therefore assumed that few, if any, were rejected because the defect was discovered at the induction examination, although there is a remote possibility that a few were mistaken for some pathological process which was a basis for rejection. In the other direction, there is no evidence by which to assume there is an increased incidence of the anomaly in individuals having conditions that might be a cause for rejection. So selection by pre-service examinations seems to have no significant influence on the series.

Because naval and Marine Corps personnel are subjected to periodic examination by radiogram, there is also a possibility of some reduplication in the series under discussion. However, the great majority of the photofluorograms reviewed were taken at separation centers from which the personnel returned to civilian status. And because per-

sonnel remaining on active duty are not ordinarily examined more frequently than every 6 months, it is not likely that more than a very few, if any, received more than one picture in the series as the study covered only an approximate period of 3½ months (1 Mar. 1946 to 15 June 1946).

TABLE 1.—*Analysis of 25,000 photofluorograms as to incidence of azygos lobes*

Stibbe's classification	Percentage	Total
Type A.....	3.71	15
Type B.....	81.19	328
Type C.....	15.10	61

No analysis could be made of the age incidence as this information did not accompany more than 3 percent of the films studied. But considering the average age incidence of service personnel, it must be assumed that the great majority were bracketed by the ages of 20 and 40 years. Probably less than 2 percent of the series represented the female chest, so no comparative analysis in this respect was attempted.

In the 150,000 photofluorograms of the series, the azygos lobe was identified in 1,575, or 1.05 percent, of the cases. It is felt that this figure is not in excess of the true incidence for reasons already discussed, and because doubtful cases were never classed as azygos lobes. Finally, it is not assumed that recognition of the anomaly in the photofluorogram was 100 percent efficient.

Analysis of the last 25,000 photofluorograms of the series according to Stibbe's classification did not substantiate his belief that there is probably an equal incidence of all 3 types. Results of this analysis are tabulated in table 1.

Of course individual interpretation is a variable factor and must be considered in any comparison of works.

It should be noted here also that many of Stibbe's Type C lobes appeared more dense than the rest of the apical parenchyma, which is in keeping with Brown's and Braverman's report of such occurrences.

The results of still further analysis of the 25,000 photofluorograms with reference to types of variation are shown in table 2.

TABLE 2.—*Analysis of 25,000 photofluorograms as to types of variation of azygos lobes*

Characteristic denoting azygos lobe	Percentage	Total
Classical pattern.....	55.69	225
Reversed comma-shaped density alone.....	20.05	81
Curving linear shadow alone.....	8.17	33
Difference in radio-translucence of parenchyma.....	1.98	8
Resembling normal broncho-vascular markings.....	5.20	21
Appearing as lateral angle of manubrium, as hooked projections from mediastinum, or as hilar nodes and markings.....	8.91	36

SIGNIFICANCE

Thus far, the azygos lobe has had its most practical significance in the confusion it may cause interpreters of the radiogram. This in itself justifies a thorough understanding of the anomaly and a familiarity with all of its variations, but other reasons for its accurate recognition have also been reported.

Rosenberger (10) reported a complete atelectasis of the azygos lobe alone in a child with a cyst of the larynx. The two conditions were coincidental as the atelectasis was due to lack of any demonstrated bronchial supply to the lobe. In another case Mueller reported constriction of the supplying bronchus by the azygos vein with resulting mucus-filled dilatations and fibrosis in the lobe.

Bendick and Wessler reported a case of pleural effusion into the meso-azygos with subsequent widening of the fissure by increasing fluid pressure, and a case of localized infiltration in the azygos lobe alone in a patient with leukemia and mediastinal adenopathy. According to Kayne, Keijser also reported a case of tuberculous infiltration confined only to the azygos lobe.

In 1930, Mackmull reviewed the physical signs incident to the azygos lobe and called attention to the fact that they varied from the normal even when the lobe itself showed no pathology.

As more attention is given to the anomaly, it will, of course, become more commonly recognized and may consequently assume a greater importance for clinicians. Any chest condition with an incidence as high as 1 percent must of necessity be given clinical as well as radiological consideration in certain differential diagnoses if the ultimate in diagnostic efficiency is to be attained.

SUMMARY

1. There is not infrequent difficulty in the differential diagnosis of certain peculiar shadows occurring in the upper right lung field of radiograms.

2. Various observers have described many of these peculiarities and established their identity with the presence of an azygos lobe.

3. No convincing data in regard to the incidence of the azygos lobe have heretofore been recorded, nor has there been any systematic study of its most common variations, but the present supplementary study was made with these two objectives in mind.

4. The azygos lobe was found to have an incidence of 1.05 percent for the entire series, and tabulations were made of its more common variations for the last 25,000 photofluorograms of the series. The reader is referred to these tables.

5. The result of this study is significant in that the azygos lobe was

found to have an incidence greater than is generally supposed and again calls attention to the fact that its variations in the photofluorogram may easily be confused with other conditions of the chest, either physiological or pathological.

REFERENCES

1. ANSON, B. J. and SMITH, H. V.: Accessory pulmonary lobe of azygos vein: anatomical report of 3 cases. *Am. J. Roentgenol.* 35: 630-634, May 1936.
2. BENDICK, A. J. and WESSLER, H.: Azygos lobe of lung. *Am. J. Roentgenol.* 20: 1-6, July 1928.
3. BROWN, S. and BRAVERMAN, M.: Azygos lobe of right lung. *Radiology* 17: 575-576, September 1931.
4. CAIRNEY, J.: Lobe of azygos vein; note on 2 additional cases. *J. Anat.*: 58: 54-58, October 1923.
5. GEDDES, A. C.: Apparent triplication of apex of right lung. *J. Anat. & Physiol.* 45: 11-15, October 1910.
6. KAYNE, G. G.: Accessory lobe of azygos vein: review and case. *Lancet* 2: 1231-1232, December 6, 1930.
7. MACKMULL, G.: Relation of anatomical variations to physical diagnosis; physical signs incident to an accessory pulmonary lobe (azygos lobe). *Am. Rev. Tuberc.* 22: 286-291, September 1930.
8. MATHER, J. H. and COOPE, R.: Accessory lobe of azygos vein. *Brit. J. Radiol.* 1: 481-485, December 1928.
9. NELSON, H. P. and SIMON, G.: Accessory lobe of azygos vein. *Brit. M. J.* 1: 9-11, January 3, 1931.
10. ROSENBERGER, H. C.: Cyst of larynx and lobus azygos of lung; case report. *Laryngoscope* 37: 360-366, May 1927.
11. STIRBE, E. P.: Accessory pulmonary lobe of vena azygos. *J. Anat.* 53: 305-314, July 1919.
12. STOLOFF, E. G.: Azygos lobe of lung. *Am. J. Roentgenol.* 22: 466-468, November 1929.
13. UNDERWOOD, E. A. and TATTERSALL, N.: Accessory lobe of azygos vein; record of 14 cases, with special reference to heredity as aetiological factor, and to pathological features of condition. *Tubercle* 15: 1-12, October 1933.

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Ives, Howard R., Lieutenant (MC) USNR (*Gangrenous Appendices Epiploicae*, p. 1889). B. A., Williams College, 1933; M. D., Yale University School of Medicine, 1937. Intern, Rhode Island Hospital, Providence, R. I., Dec. 1937-Dec. 1939; fellow in surgery, Mayo Clinic, Rochester, Minn., Jan. 1940-41; surgeon in the Emergency Service, Hill End Hospital, St. Albans, Herts, England, and posted to work in St. Bartholomew's Base Hospital, June 20, 1941-; surgical resident, St. Bartholomew's Hospital and chief surgical assistant to the professor of surgery, University of London, 1941-43; surgeon, Mid-Herts Hospital, St. Albans, Herts, England, 1942-43.

Jessup, Richard, Lieutenant (MC) USNR (*Dystrophia Myotonica (Myotonia Atrophica)*, p. 1865). B. A., State University of Iowa, 1935; M. D., Johns Hopkins University School of Medicine, 1939. Intern, University Hospitals, Minneapolis, Minn., July 1939-July 1942; assistant resident and resident physician, Strong Memorial Hospital, Rochester, N. Y., July 1942-Nov. 1943; instructor in medicine, University of Rochester School of Medicine and Dentistry, Nov. 15, 1943-Sept. 1, 1944. Member: American Medical Association and Monroe County, N. Y., Medical Society.

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Mason, James T., Jr., Commander (MC) USNR (*Hydronephrosis Simulating Peptic Ulcer*, p. 1907). M. D., University of Virginia Department of Medicine, 1940. Intern, Bellevue Hospital, New York, N. Y., 1940-41; resident, urology, University Hospital, Ann Arbor, Mich., 1946-.

Mazet, Robert, Jr., Captain (MC) USNR (*How Shall We Evacuate the Casualties?* p. 1848). Ph. B., Brown University, 1924; M. D., Columbia University College of Physicians and Surgeons, 1928. Intern, Presbyterian Hospital, N. Y., Sept. 1928-Nov. 1931, and Hospital for Ruptured and Crippled (now Hospital for Special Surgery), New York, N. Y., Mar. 1933-Mar. 1934; attending surgeon, Meadowbrook Hospital, Hempstead, N. Y., 1935-July 1946; assistant surgeon, Hospital for Ruptured and Crippled (now Hospital for Special Surgery), 1937-July 1946; chief, orthopaedic service, U. S. Veterans Hospital, Los Angeles, Calif., July 1946-. Fellow: American College of Surgeons and American Academy of Orthopaedic Surgeons. Diplomate: American Board of Orthopaedic Surgery.

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SUPPLEMENT TO UNITED STATES NAVAL MEDICAL BULLETIN



**PUBLISHED FOR THE INFORMATION OF THE
MEDICAL DEPARTMENT OF THE NAVY**

**HABILITATION
AT THE
NAVAL HOSPITAL
PHILADELPHIA**



MARCH 1946

**BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.**



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REHABILITATION
AT THE
U. S. NAVAL HOSPITAL
PHILADELPHIA

SUPPLEMENT TO
U. S. NAVAL MEDICAL
BULLETIN



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BUREAU OF MEDICINE AND SURGERY
U. S. NAVY

2000

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Supplement to U. S. NAVAL MEDICAL BULLETIN

MARCH 1946

REHABILITATION AT THE U. S. NAVAL HOSPITAL, PHILADELPHIA

A. INTRODUCTION

MELVILLE J. ASTON
Captain (MC) U.S.N.

Rehabilitation is a relatively new term in military medicine, but its significance is old. The physician has always had in mind the return of his patient to full function as well as to full health. Perhaps in civilian hospital practice more emphasis has been placed on the treatment of active disease, since convalescence and its attendant problems of readjustment, mental as well as physical, take place mostly in the patient's home. But in the Navy the hospital has routinely been the site of the patient's complete restoration to normal, so that from the hospital he might be discharged to full duty. Therefore ideologically it was not difficult for the Naval medical officer to adapt himself to the further step of preparing the casualties of war for their return to a useful role in society in addition to restoring them to physical health.

But that task did present complex problems of organization, personnel and equipment, especially with regard to certain categories of patients; notably the blinded, the deafened, and those who had suffered a loss of limb. The Surgeon General of the Navy early recognized this fact and made plans accordingly. Not only were all Naval hospitals in the United States prepared to deal with the return to civilian life of the average medical dischargee, but certain Naval hospitals were designated, staffed, and equipped to deal with the highly specialized needs of particular groups of cases.

The U. S. Naval Hospital at Philadelphia, in addition to its function as the major hospitalization facility for the Fourth Naval District, has also served as a rehabilitation center for certain types of cases. These include: All the blinded of the Navy, Marine Corps

and Coast Guard; all the hard-of-hearing of those services; about half of the amputees (the others being treated at the U. S. Naval Hospital at Mare Island, California); and a smaller proportion of those suffering with combat fatigue, in the management of which cases several Naval hospitals have shared.

The experiences of these rehabilitation activities at this hospital deserve to be recorded in the medical literature, and for several reasons. They constitute an important chapter of the medical history of the recent war. The problems of organization and procedure which were met and solved have valuable lessons for Naval medicine. The experiences afforded by the study and treatment of large numbers of cases of certain types of disability by selected staffs with special skills and with every advantage of equipment have produced much that should be useful to the medical profession in civilian practice. Since most of these patients will continue to be under Government surveillance as veterans, their future progress offers invaluable opportunities for observation and follow-up to determine the ultimate value of methods of treatment, prosthetic appliances and programs of re-education and training. The lessons learned, and to be learned, will redound to the benefit of the patients themselves under the future care and guidance of the medical officers of the Veterans' Administration. Finally, now that the war has ended, the work-load of rehabilitation is rapidly falling, and many of the medical officers who carried out the program will be transferred to other stations or will return to civilian life. Therefore the time seems ripe for recording their experiences.

Accordingly, a series of reports by the members of the several staffs involved have been prepared under the editorial supervision of the rehabilitation officer. Carefully correlated to avoid duplications and omissions, these reports constitute in effect a symposium on each of the major topics concerned. In order to insure their relationship in medical indexes, all articles on different phases of the same major topic carry the same primary title, and, in addition, a serially numbered subtitle that designates the part of the subject discussed therein.

The first group consists of 14 papers on various aspects of the rehabilitation of amputees. Based on 829 amputations in 769 patients, this symposium embodies much that is of value to those interested in this branch of surgery. Special attention is called to the work in the field of prosthetics. This activity pioneered in the making of plastic prostheses which were "custom-built" rather than "assembled," and with an initial permanent limb rather than a temporary pylon, measures that are now being adopted elsewhere. Some valuable improvements in design and function have been achieved. The manufacture of these artificial limbs has been carried out entirely

by Naval personnel, trained here for the purpose. Of special interest, also, is that which has been accomplished in the educational rehabilitation of amputees, including their prevocational training, and their instruction in the driving of automobiles, this latter an original activity at this hospital.

The program of hearing and speech rehabilitation has also involved the charting of courses in new and strange seas. Some of the problems met and solved were the development of exact methods for evaluating type and degree of hearing loss, the fitting of hearing aids on the basis of the individual's particular auditory handicap, the teaching of speech reading, auditory training, the use of hearing aids and speech correction to large numbers of patients, and their adjustment to conditions in civilian life after leaving the service. The subject is covered in 9 articles, based on an experience with over 2,800 such patients.

In the rehabilitation of the blinded there were likewise new problems to be solved, particularly as they arose in the retraining of our patients, all newly blinded young adults, whereas previous methods were largely based on experiences with those who were blind from infancy or early youth. Our efforts have been directed toward preparing these patients to take their places as self-sufficient workers in a seeing world, rather than as workers in a sedentary craft at home. An example of a new field in which some of our blinded patients have been gainfully established is that of technician in the developing of x-ray films. Because many of our patients were blinded as a result of injury in battle, they suffered deformities of the socket that made difficult the fitting of glass prostheses. It became possible, therefore, in many cases to apply the use of the acrylic prosthesis developed in the Naval Dental School at Bethesda. In 7 articles are presented the experiences with 157 blinded sailors and Marines.

The scope of the work of the neuropsychiatric service in this hospital may be judged from the fact that in the first 9 months of 1945, a total of 1,762 patients were disposed of by medical survey. This hospital has been fortunate in the possession of the Convalescent Annex at Swarthmore, Pennsylvania, where certain types of ambulatory patients can receive rehabilitative treatment and training under ideal conditions of housing and environment. Patients with combat fatigue were selected for management in that activity of the hospital, and it is gratifying to report that 55 percent of such patients were returned to limited duty, 5 percent to full duty, and only 40 percent were discharged from the service. This record is all the more significant, since such patients are less likely to be returned to duty the longer it has been since they incurred their disability; yet most of them had arrived here many weeks and months after leaving a

battle area. Four members of the neuropsychiatric staff combine to report the rehabilitation program of that service.

The many-sided activities of the American Red Cross are a matter of common knowledge. Yet it may be news to some that the Red Cross plays an important role in the routine function of a Naval hospital. Physicians in civilian hospitals have long placed great reliance on the staffs of their social service departments for making the contacts with the patient's family and environment to integrate the patient and his individual problems with the purely medical aspects of his case. Without such contacts, medical efforts in the hospital would often be doomed to failure, or would lose continuity after the patient's return to his home. The trained social workers of the American Red Cross perform that contact function in Naval hospitals, and, by reason of organized contact with a Red Cross unit in the patient's home town, wherever that may be, can make the efforts of the hospital effective, even though the patient's home be in the remotest part of the country. The field director of the Red Cross Service in this hospital and four of her staff associates have prepared a report of their activities here, with particular reference to the program of rehabilitation.

In conclusion the writer takes this opportunity to pay tribute to all the members of the staff of this hospital who by their professional skill, fidelity of purpose and untiring efforts have made possible the fine record here achieved in the rehabilitation of those who suffered handicaps while in their country's service.

B. AMPUTEE REHABILITATION

I. THE PROGRAM; ITS ORGANIZATION, ACHIEVEMENTS, AND FUTURE

RICHARD A. KERN
Commodore (MC) U.S.N.R.
and
WALTMAN WALTERS
Captain (MC) U.S.N.R.

In December 1943 the U. S. Naval Hospital, Philadelphia, was designated as the amputation center to provide orthopedic and prosthetic treatment for all Naval amputees whose homes were situated east of the Rocky Mountains. Since that date, 801 amputees have been admitted to this hospital. Of these, 65 percent had suffered their injuries in combat on land or sea; the others as a result of accident or disease.* Over 60 percent of these patients presented stumps that required further surgical treatment. All of these patients were candidates for prostheses and for re-education and training to fit them again into a useful role in life. Some of this work is, of course, still in progress so that final figures cannot be cited. However over 400 operative procedures have been carried out; more than 500 prostheses have been fitted and completed; and more than 300 patients have been returned to civil life. The experiences gained and the results achieved with these patients were productive of much that should prove interesting and useful to the medical profession. Therefore a symposium on all phases of amputee management is herewith presented in a series of articles by the members of our staff.

HISTORY AND ORGANIZATION

The program was initiated under the direction of the Surgeon General of the Navy in December 1943 by the Medical Officer in Command of this hospital, Captain Jesse W. Allen (MC) U.S.N., and the Chief of Surgery, Captain Camille M. Shaar (MC) U.S.N. To Captain Shaar belongs in great measure credit for much of that which has been accomplished. After the detachment of Captain Allen in March 1945, the program was effectively continued under the supervision

* Thirty-three percent of amputations were necessitated as a result of accidental injuries, many of which might have been avoided.

of the present Medical Officer in Command, Captain M. J. Aston (MC) U.S.N. Through their efforts and through the cooperation of the Bureau of Medicine and Surgery, the professional staff of the hospital was augmented from time to time with experienced surgeons, orthopedists, and others with special skills to meet the needs of the growing program.

Prosthetic manufacture

To provide prosthetic appliances for a large number of amputees it was necessary to establish an artificial limb shop and to assemble personnel to fit and manufacture prostheses. In April 1944 the limb shop, construction of which had been started 3 months previously, was completed.

The first need was to procure a man experienced in all phases of artificial limb design and construction. Mr. Basil Peters, a technician with 20 years of limb-making experience and, since 1941, engaged in the experimental development of plastic limbs at the C. A. Frees Company, was commissioned Ensign H(S) U.S.N.R., and on 15 May 1944 reported here for duty and was placed in charge of the limb shop. Under his direction the necessary tools, machinery, and materials were ordered, and by September the equipment of the shop was completed.

Attempts were made to recruit from civil life men who were experienced in limb-making, but without success. Therefore enlisted men with cognate skills in working with the necessary tools and materials, such as bracemakers, woodcarvers, cabinetmakers, machinists, patternmakers, and leatherworkers, were sought for throughout this Naval district and assigned to duty in the limb shop. The first six men so assigned included three bracemakers, two woodworkers, and a leatherworker.

The next few months saw the development of Naval plastic prosthetic manufacture to its present stature. Many of the problems of personnel training and prosthetic construction centered in the choice of material. There was a critical shortage of properly seasoned willow wood. Aluminum was hard to get in sufficient quantity. More important than either of these facts were the lack of skilled labor and the length of time necessary to train personnel in working willow wood or aluminum. This would have delayed the prosthetic program for many months. Mr. Peters' experience, however, had convinced him that the adaptability of plastic material and the simplicity of its use in prosthetic manufacture would make it possible to train men in limb construction in a period of only 8 to 12 weeks. His belief was abundantly confirmed.

The first 2 months were spent in the construction of the collapsible wood master-forms used in plastic lamination. In order to obtain maximal production as soon as possible, assembly-line methods were instituted. Each man was trained for 1 phase of work. With the increase of personnel to 12 men, it was possible by the end of July 1944 to complete the first 12 prostheses. By December production was increased to 30 each month.

In all military amputee facilities of the last war and this war, it had been the rule to supply patients with a temporary prosthesis or pylon. This was thought desirable from the standpoint of morale, since patients could be made ambulatory at the earliest possible time instead of having to wait for a permanent prosthesis. Yet pylons have these important disadvantages; they are heavy, they are rarely correctly fitted and aligned, and patients may develop undesirable gaits and postures which later call for correction. Because a permanent plastic prosthesis could be furnished here as soon as the patient's condition let him be ambulatory, it was decided to supply our patients with a permanent prosthesis from the start. This had a decidedly beneficial psychologic effect upon the patients, as they had a presentable as well as a functioning limb from the beginning.

Our equipment and personnel also made it possible from the beginning to make all parts of the prosthesis, except for certain patented items, such as the Miracle hand, and utility hook, or such simple standard items as the hinges for the joints. Our prostheses, therefore, have been more nearly "custom-built" than "assembled." This, too, has made for greater individualization and more accurate fitting.

It soon became evident that with the great demand for specially designed braces and mechanical appliances, it was necessary to establish a brace department as a separate division of the limb shop. In addition an orthopedic shoe department was set up to provide arch supports and various shoe adjustments. Therefore the personnel was increased to 25 and production rose in accordance with the demands. By June 1945 the output reached 55 prostheses, 40 braces and 100 pairs of arch supports per month. Up to 19 October a total of 513 artificial limbs had been completed.

The proper medical care of amputees involved the use of various modalities of physiotherapy and physical training. From the beginning, therefore, a close liaison was maintained with the Department of Physical Medicine.

Since rehabilitation includes all activities and procedures that contribute, not only to the recovery of the patient from his physical disability, but to the preparation for his return to a useful and productive life in or out of the service, the Educational Service and the Division of Occupational Therapy were integrated in the program at

the outset. By reason of the nature of their disability, amputees remain long in the hospital. Much could, therefore, be accomplished by an educational program that began within 24 hours of a man's admission to the hospital and continued throughout his stay.

The Rehabilitation Board

In accordance with a directive from the Bureau of Medicine and Surgery, a Rehabilitation Board, consisting of the Chief of Surgery, the Chief of Medicine, the Chief of the Eye, Ear, Nose and Throat Service, and the Chief of Neuropsychiatry, was organized in April 1944. Captain Shaar, the Chief of Surgery, was its senior member and the Rehabilitation Officer until his detachment in February 1945. One of us (R.A.K.) was a member of the Board from its inception, and the Rehabilitation Officer succeeding Captain Shaar. The other (W.W.), as Chief of Surgery, has been a member since December 1944. The function of the Board has been to direct and coordinate all phases of rehabilitation in this hospital, including the programs for the deaf, the blinded, and for combat-fatigue patients, as well as the amputees. One of its important activities has been a weekly meeting, attended by representatives of all interested departments, including the Red Cross and the chaplains, for a discussion of current problems.

ACHIEVEMENTS

By the time of this writing (October 1945), 801 amputees had been admitted for rehabilitation. Of these, 305 have been discharged and another 150 are due for discharge within a few weeks. These patients afforded an opportunity for collective experience in this field that is outstanding and in some respects unique in American medicine. We here enumerate some of the benefits and achievements that have accrued.

Methods of surgical technic and procedure could be studied and evaluated, not only in a vast case material, but under circumstances that were peculiarly favorable. Important among these is the control over patients which a military establishment affords.

The fact that prostheses were manufactured in the hospital by personnel which by reason of its Naval status had no other prosthetic commitments, afforded an invaluable opportunity for the closest co-operation between surgeon and limb-maker. This achieved a mutual understanding of their respective problems and an exchange of ideas that bore valuable fruit. Patients benefited by the early and personalized service jointly rendered by surgeon and limb-maker. There also resulted improvements in technic and construction, at least one of

which, a forearm prosthesis with pronation-supination control of an artificial hand, embodies a major advance.

There have accumulated carefully compiled medical records that should prove most useful to all students of this subject, not only now but in future years. To insure their availability, they have been segregated in our record library, suitable extracts on cards for quick reference have been prepared, and salient data have been tabulated according to amputation sites. A follow-up system is in operation to make the record continuous throughout the amputee's lifetime.

A part of the medical data that deserves special mention is the photographic record. Pictures of all stumps were taken on admission and discharge, and, in selected patients, at intervals throughout their stay. These were attached to photostatic prints of patients' health records. Motion pictures, some in color, were taken of operative procedures and of activities for training in the use of prostheses and these in turn proved helpful in the instruction of personnel and of patients. In order that these photographic records shall have the widest possible use, a duplicate file is to be supplied to the Naval Medical Museum in Washington. Too much praise and recognition cannot be given to Lieutenant Commander Alex A. Gravesen H(S) U.S.N.R., director of the Photographic Laboratory of this hospital, and to Lieutenant, junior grade, Genevieve Lee H(W) U.S.N.R., artist of that laboratory staff, for the splendid services they have rendered in this very important work. The excellence of their product may be judged from the fine illustrations that accompany several of the articles in this series of reports.

In nonmedical activities, much valuable experience has likewise accrued. Space permits but brief reference to a few. Educational services could be extended to these patients to a greater degree than most other groups because of the longer period of hospitalization of amputees. Of peculiar nature and unusual value in the educational work was the prevocational training in industry, a development that was an original contribution in this hospital. Another "first" was the course of training for amputees in the operation of automobiles.

There has been afforded and utilized an excellent opportunity to train personnel, both officers and enlisted men, in all aspects of this program. Thus medical officers, nurses, physiotherapists, and workers in prosthetic manufacture were trained in considerable numbers. A prime purpose of such training was the anticipated staffing of two amputee centers in other Naval hospitals in other parts of the country. The end of the war, however, rendered them unnecessary.

The time would seem to be ripe to make available to the medical profession at large, as well as to the medical officers of the armed forces, the information and experience gained in this amputee center.

The ending of the war precludes the admission of any appreciable additional number of amputees to this hospital. Moreover the impending return to civilian practice of many of the medical officers who shared in this experience will end their further participation in this work.

THE FUTURE

There is every reason to believe that the work with amputees at this hospital will continue for years to come. The U. S. Naval Hospital, Philadelphia, by special arrangement with the Veterans' Administration, has cared for veterans since the last war and in larger numbers than any other Naval hospital. It is reasonable to assume, therefore, that this policy will continue and that it will be expanded, particularly to include all amputee veterans in this part of the country.

Such a program would possess a number of obvious advantages. From a scientific standpoint it would make possible the extension of work already so auspiciously begun. For instance it would be possible to follow the individual patients for the rest of their lives. It should be recalled that the follow-up of these individuals is made relatively easy, because as recipients of pensions they can always be traced. It would, therefore, be possible to evaluate in terms of long-range data the relative merits of the various amputation technics. Similarly much could be learned about the suitability of different types of prostheses and the durability of materials.

Further obvious advantages would lie in the opportunity to train medical officers in amputation surgery and the care and rehabilitation of the amputee. In the limb shop an adequate personnel could be instructed in all phases of the manufacture of prostheses and braces.

Finally from the standpoint of administration there would result a close liaison between the Navy and the Veterans' Administration. A service patient could then be transferred to veteran status without any interference or delay in the smooth handling of his medical and social problems.

CONCLUSIONS

From the over-all experience gained in this amputation center, we would like to present certain conclusions that deserve special emphasis.

1. Men returning to this country with open stumps have had their convalescence delayed thereby for many months. Indeed the average time spent by the amputee in this hospital covered a period of 8 months. It would appear that this period could have been shortened materially had open-flap amputations been done in suitable cases.

instead of the classic chop-guillotine operation. More attention could have been paid to the application of traction at an early stage to prevent the complications arising as a result of an open stump in which bone projected beyond soft tissue parts.

2. The cooperation between various specialists engaged in the care of the amputee in this hospital and their intense interest in these patients have accounted, we believe, for remarkably fine results, even in those cases in which patients were received here many weeks following their amputations.

3. One-third of the amputations were necessitated as a result of accidental injuries and not of wounds in combat. Twenty-three percent of the amputations were the result of duty accidents that might have been avoidable. These include injuries by contact with various types of machinery, ammunition hoists, gun mounts, fouled lines, and ammunition explosions. An additional 10 percent were necessitated as a result of accidents sustained while on liberty. The inference is obvious: Better indoctrination in boot camp and constant alertness by division officers.

ACKNOWLEDGMENT.—Acknowledgment is made to Virginia Hannon, Hospital Apprentice, first class, and Bessie Goodkin, Pharmacist's Mate, third class, for their untiring and enthusiastic efforts in the collection and assimilation of the data and experience obtained for the Amputee Service.

II. STATISTICAL ANALYSIS OF 829 AMPUTATIONS IN 769 PATIENTS

DONALD T. JONES

Lieutenant Commander (MC) U.S.N.R.

and

WILLIAM L. WHITE

Lieutenant, junior grade (MC) U.S.N.R.

Since the U. S. Naval Hospital in Philadelphia was designated to serve as an amputee center, 769 active duty patients have been admitted to this specialized rehabilitation service. These constitute about 40 percent of such casualties in the Navy and Marine Corps during the period of the war. The earlier patients were principally those transferred here from other medical activities, most of whom had been partially or completely treated from a surgical point of view. These men were sent to this hospital for completion of surgical treatment, to be fitted with prostheses and to participate in the program of amputee rehabilitation. More recently, however, we have received patients who were injured in combat from 2 to 12 weeks previously, very few of whom had received any definitive or reconstructive treatment following their initial amputation.

Our cases, therefore, reflect the general experience of Naval medical officers in this field, and because of the numbers involved, an analysis of our material is statistically significant. In this article are presented certain clinical data, including the anatomic distribution of the lesions, the circumstances and causes of injury, the immediate indication for amputation, the type of operation initially performed, the condition of patient and stump on admission here, and other items of comparable clinical interest.

Anatomic distribution of amputations

Among the 769 amputees there were 829 amputations, since 58 patients had suffered partial loss of more than one extremity, and one patient presented amputations involving three extremities. Of the 58 double amputees, 33 are classified as major-major amputees, 22 as major-minor and 3 as minor-minor. The anatomic level of amputation has been used to determine major and minor status without emphasis on the final functional result, because surgical treat-

ment has not been completed in approximately one-third of the cases. Amputations are designated as major if the site of transection is at or above the proximal wrist or ankle joint. Of the 829 amputations, 695 (83.3 percent) were considered as major. The anatomic distribution of the amputations is as follows: Fingers 45, partial hand 22, forearm 79, arm 115, toes 24, partial foot 44, below knee 230, and thigh 270.

Disease was responsible for 13 amputations in 12 patients in this series. Seven of the 12 men were operated upon because of sarcoma, 2 for peripheral thrombosis, and 3 for Buerger's disease, 1 of whom had bilateral high thigh amputation. The remaining 757 amputees, having a total of 816 amputations, suffered loss of limb as a direct or indirect result of *trauma*.

The circumstance of injury

Combat on land or sea accounted for 489 (64.6 percent) of the 757 posttrauma amputees. Accidents *on duty* resulted in amputations in 188 men (24.8 percent), while accidents occurring during *leave or liberty* accounted for the loss of limb in 80 individuals (10.6 percent). The distribution of the amputees in terms of circumstance of injury and of the branch of the service involved is presented in table 1. It is of interest to note that these amputees are almost equally divided between Navy and Marine Corps personnel. Sea-combat and accidental injuries account for all but 25 of the Navy amputees, while Marine amputees resulted chiefly from land combat. These figures, with 2 exceptions, are easily understood when the proportionate size of these 2 organizations is considered, in addition to the type of combat activities in which each have engaged. But the number of accidents occurring to sailors on leave is disproportionately higher (8:1) as compared with Marines, since the numerical ratio between these services is only 5:1. There are relatively fewer Navy amputees, partly at least because amputees have far less chance of survival in sea combat than ashore.

TABLE 1.—Navy and Marine amputees resulting from traumatic injuries in terms of circumstances of injury

	U. S. Navy	U. S. M. C.	Total
Land combat.....	25	318	343
Accidental duty out of U. S.....	45	20	65
Accidental duty in U. S.....	49	13	62
Accidental leave-liberty in U. S.....	71	9	80
Accidental aboard ship.....	58	3	61
Combat aboard ship.....	143	3	146
Totals.....	391	366	757

With the heavy equipment in Naval installations and aboard ship, the incidence of accidental injury resulting in amputations is surprisingly low in view of the great proportion of relatively inexperienced enlisted personnel. Accidental injuries incurred while on liberty resulted in amputations in 80 patients. This does not seem unusually large if one considers the size of the wartime Navy.

Theaters of operation

A study of the amputations resulting from combat injuries reveals an interesting distribution, when considered in terms of the Japanese-Pacific and the European-Atlantic wars. The Iwo Jima, Okinawa, Saipan, Guam, and Peleliu campaigns accounted for 297 (86.6 percent) of the 343 amputees injured in land combat. Only 6 land-combat amputees were wounded in the European theater, all 6 of whom were in the Navy. Among the 146 derived from combat aboard ship, 50 were injured in the European-Atlantic war, while 96 suffered loss of limb following sea-combat trauma in the Pacific war.

TABLE 2.—*Traumatic agents in 757 posttraumatic amputees*

Mortar shell fragments	166
Artillery shell fragments	78
Bullets	75
Bomb fragments	47
Land mine explosions	20
Hand grenade fragments	41
Knife (by enemy)	1
Booby trap explosions	3
Burns	4
Suicide plane explosions	32
Deck heave (subsurface explosions)	34
Other explosions	20
Airplane accidents	24
Fouled lines	11
Crushes	39
Falls	7
Machinery	34
Saw injuries	8
Axe injuries	4
Knife injuries	6
Surgical errors (vessel injuries)	3
Surgical errors (tight casts following fracture)	3
Athletic injury	1
Motor vehicles (including tanks, bulldozers, etc.)	44
Trains, trolleys, etc.	31
Shotgun accidents	20
Frostbite	1
Total	757

Traumatic agents

In table 2 are presented the types of traumatic agents which produced injuries necessitating amputation in 757 amputees. As can be seen, armament accounted for the greatest majority of the instruments of trauma, and in this series of cases, fragments from Japanese mortar shells accounted for more amputations than any other type of agent. Suicide-plane explosions played a rather prominent part in sea-combat injuries, accounting for almost as many amputees as *deck heave*, which is sustained by standing aboard ship at the instant the deck is thrust upward by a shell, torpedo, or mine explosion. The incidence of amputations resulting from being caught in *fouled lines* is somewhat higher than might be expected. The 7 falls each resulted in severe fractures which later required amputation due to infections or circulatory disturbances. *Machinery accidents* included those sustained from several types of equipment, particularly gun mounts, hoists and steam shovels. Circular-saw and axe injuries were principally confined to hand or forearm and foot or leg respectively. *Knife injuries* in 2 patients severed fingers, while in 4 cases the femoral artery was cut, necessitating thigh amputations in 3 and below-knee amputation in another. Only one of these patients had an amputation subsequent to injury sustained in athletic training. He developed gas gangrene at the site of a baseball spike wound and compound fracture.

A small group, but important from the standpoint of surgical practice, consists of six patients (0.8 percent) in whom *surgical error* was responsible for amputation. In three of these cases the accidental injury and subsequent ligation of the femoral artery in the course of an operation of election ended in circulatory gangrene and amputation. *Tight casts* applied to fractures, followed by marked swelling and interruption of blood supply, resulted in loss of toes in one case and thigh amputations in two others.

Accidents incurred while on liberty

All train, trolley, and subway injuries were incurred while on liberty with two exceptions, in which cases the individuals were travelling under a duty status. Shotgun accidents, all during liberty periods, resulted in partial loss of an extremity in 20 instances. Frost-bite from exposure resulted in amputation of both lower extremities in 1 individual.

Indications for amputations

The surgical indications leading to 829 amputations have been listed under 8 headings in table 3. As stated previously, 12 patients

TABLE 3.—*Indications for 829 amputations in 769 amputees*

Traumatic amputations	303
Partial traumatic amputations	198
Loss of blood supply	235
Osteomyelitis	46
Gas gangrene	34
Buerger's disease	4
Sarcoma	7
Peripheral thrombosis	2
Total	829

suffered amputation because of nontraumatic indications: 3 with Buerger's disease, 7 because of sarcoma, and 2 for spontaneous peripheral thrombosis. Since 1 of the patients with Buerger's disease is a bilateral amputee, there remain 816 amputations which were performed subsequent to traumatic injury. Of these, 303 are classified as traumatic amputations. This group includes all of those in which a distal portion of the extremity was actually severed by the force of trauma, or so nearly so that it was attached by only a minimum of soft tissue which was incapable of sustaining life in the part. The 198 partial amputations include those in which the loss of soft tissue and bone was so extensive that repair and recovery were considered impossible. Loss of blood supply served as the indication in 235 amputations. In some of these amputation was performed promptly when it was apparent that the loss of circulatory function was irreparable; however most of these amputations were performed after a period of observation to determine the adequacy of collateral blood supply. Osteomyelitis resulting from infection in compounded wounds was listed as the indication in 46 instances. These extremities, almost without exception, had extensive soft tissue defects, often associated with considerable bone loss. These amputations were usually performed more than 3 weeks after injury. The records of 34 patients state that the indication for amputation was gas gangrene. However there was seldom sufficient evidence recorded to support this diagnosis, so that this figure may be higher than the actual incidence of this wound complication. Particularly open to question are a few cases in which early amputation (under 48 hours) was performed because of "crepitation," which might well have been due to air forced into the tissues at the time of injury and not to gas formation from infection.

Time interval between injury and amputation

Of the 816 amputations secondary to trauma, 491 (60.2 percent) were performed within 24 hours of injury. Eighty amputations (9.8

percent) were performed on the second or third day, while 156 (19.1 percent) were amputated after 72 hours and up to 3 weeks. The remaining 89 amputations (10.9 percent) were performed after 3 weeks. We have designated these periods as *immediate*, *immediate-delayed*, *delayed* and *remote*. The higher incidence of immediate and immediate-delayed amputations serves to indicate the rapidity with which the injured received definitive surgical treatment, even under battle conditions.

Types of amputations

We have classified the 829 amputations into three types, depending upon the primary technic of amputation employed. The classical *guillotine* technic was used in 570 instances (68.8 percent), while 45 (5.4 percent) were termed *flap-open* procedures, since an attempt was made to preserve partial or adequate skin flaps. A total of 214 (25.8 percent) were closed primarily. This latter group includes those amputated for nontraumatic diseases. Most of the finger and toe amputations, and many of those done for osteomyelitis and circulatory disturbances, are also included in this group.

Amputations in terms of right and left sides

An analysis of the side of amputation revealed that 442 (53.3 percent) of the amputations were on the right side. This meets with expectancy and is not statistically significant. Almost the same ratios are found to exist between right and left upper or lower extremities. When minor amputations are considered, it is seen that 52.2 percent of them occurred on the left side, while the comparison of major amputations reveals that 54.4 percent occurred on the right side.

Length of stump

Stump length, an important factor in our task of providing prostheses, was considered too short in 51 instances to permit suitable prosthetic action. Arm and forearm amputations less than 2 inches below pectoralis or biceps insertion were considered inadequate. In the lower extremity, 2½ inches below hamstring insertion and 3 inches below ischial tuberosity were likewise judged to be too short. Among those with inadequate stump length, 4 had been disarticulated at the shoulder and 3 at the hip.

Condition on admission

Upon admission of the patients to the amputee service, 387 (46.6 percent) of the 829 stumps were open, while 67 (8.1 percent) pre-

sented sinuses, constituting a total of unhealed stumps numbering 454 (54.7 percent). In 42 of these stumps (5.1 percent) there was active evidence of osteomyelitis. Sixty-two stumps (7.5 percent) were healed on admission and ready for revision or reamputation. A total of 313 (37.8 percent) had either been closed primarily or revised prior to admission and did not require further operation (see table 4). Among the closed amputation stumps, 4 had been converted to Stokes-Gritti end weight-bearing thigh stumps, 3 had had Callander procedures, and 1 had been converted to a Syme long-leg end weight-bearing stump.

TABLE 4.—Condition on admission in 829 amputation stumps

	Open	Sinus	Healed	Revised	Total
Fingers.....	3	2	3	37	45
Partial hand.....	6	0	6	10	22
Forearm.....	25	3	9	42	79
Arm.....	61	8	9	37	115
Toes.....	6	4	5	9	24
Partial foot.....	21	11	1	11	44
Below knee.....	116	27	9	78	230
Thigh.....	149	12	20	89	270
Totals.....	387	67	62	313	829

Associated injuries

Associated injuries occurred in 405 (53.5 percent) of the patients. The most common wound was produced by shell fragments. Burns have been surprisingly uncommon, in view of modern warfare. The most serious injuries are those involving bone, which occurred in 149 instances (19.7 percent). Eight combat amputees suffered the loss of one eye, one of whom was partially blind in the remaining eye. Only one was totally blind. Fourteen patients suffered ear injuries, 11 of which were drum perforations. None of these has required a hearing aid. Complicating nerve injuries occurred in 26 patients. Associated injuries, and particularly those involving bone, often complicate the management of the amputee and necessitate prolonged hospitalization. This phase of the experience at this hospital is the subject of a separate communication.

General condition of the amputees upon admission

It is estimated that approximately 15 percent of the amputees were considered as bed patients on arrival. The remaining 85 percent were either able to walk or use crutches or wheel chairs, and have been considered as ambulatory. Only one amputee, who had lost his right forearm and left leg, was considered as an extremely grave risk. This patient had, in addition to his amputations, an infected

fracture of his right femoral neck. Upon admission, he was febrile, anemic and showed evidence of malnutrition. Infection in the right hip required extensive drainage, the patient continued to lose weight, and undermined decubitus ulcers appeared over most of his bony prominences. Gradually after 2 months of diligent supportive treatment he began to respond, and at present has gained a few pounds, and for the first time there is evidence of healing of the decubitus ulcers and the open, draining wounds.

SUMMARY

About 40 percent of amputee casualties of the Navy and Marine Corps have been admitted to the U. S. Naval Hospital, Philadelphia. An analysis of the data shows that among 769 amputees, there were 829 amputations, 58 patients having suffered partial loss of two limbs. There was one triple amputee. Of the 769 amputees, 7 had limbs removed because of sarcoma, 3 for Buerger's disease, and 2 for peripheral thrombosis. The remaining 757 patients had suffered 816 amputations as a result of traumatic injury. In this group, 489 (64.6 percent) were injured in land or sea combat. The other 268 amputees (35.4 percent) were injured accidentally, 188 of whom were on duty, while 80 were accidentally injured while on leave or liberty.

An analysis of the traumatic agents reveals that Japanese mortar fire was the most frequently observed traumatic force. Among the amputations resulting from injuries sustained in sea combat, sub-surface explosions causing deck-heave injuries, and injuries resulting from suicide-plane explosions were most common. Among accidental injuries sustained while on duty, heavy machinery, airplane accidents, crushes, and motor vehicle accidents were most frequent. The most common leave and liberty injuries resulted from train, trolley, subway, motor-vehicle, and shotgun accidents.

The most frequent indications for amputation were in order: Traumatic severance of a part, loss of blood supply, and extensive traumatic injury. Over two-thirds of the primary amputations were of the classic guillotine type. A total of 405 amputees suffered, in addition to their amputations, associated traumatic lesions that varied considerably as to their seriousness and extent. Detailed data are presented as to traumatic agents involved, amputation technics employed, time intervals that elapsed between injury and amputation, the indications that led to amputations, and the condition of the patients on admission to this hospital. There was no mortality among them after their admission here.

III. THE OPEN AMPUTATION STUMP; ITS MANAGEMENT, ADVANTAGES, AND DISADVANTAGES

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Among the 769 amputees admitted to this amputee center, there were 829 amputation stumps, since 59 patients had experienced multiple amputations. The primary technic of amputation in 570 instances had followed the now classic guillotine procedure. In another 45, the technic had varied slightly, in that partial or complete skin flaps were saved, but no attempt had been made to close these flaps. The remaining 214 stumps were closed primarily. Twenty of these were emergency battle casualties requiring major limb amputations.

The other 194 closed amputations included four groups of patients: Those requiring emergency amputations of hands, fingers, feet, or toes as a result of combat injuries; those having delayed elective major and minor amputations as a result of battle injuries; those having amputations following accidental injuries; and those in whom the indication for amputation was disease of a nontraumatic nature.

More than 70 percent of these closed amputations were performed in land-based, well-established medical facilities. On admission to this hospital, 387 of the 615 open-type stumps were unhealed, while 33 of them presented draining sinuses, and 195 were healed. This communication presents the methods of open stump management employed at this hospital, and a description of the guillotine amputation and its healing processes. The advantages and disadvantages of open stump amputation are discussed.

It has been our policy to secure complete stump healing and wait from 3 to 4 weeks before attempting any final plastic revision or reamputation procedures. This policy has presented the greatest problem encountered on this amputee service, for stump healing is slow and often prolonged, thus extending the period of hospitalization and delaying participation in the outlined program of rehabilitation. However an analysis of the operative procedures performed on 77 unhealed stumps, prior to and after admission here, reveals that 27 (35.1 percent) serious postoperative complications occurred.

When these figures are compared with the results in 379 healed stumps, in which only 64 (16.9 percent) postoperative complications were noted, it is seen that our decision was well founded. After

healing has been secured, revision or reamputation as indicated is performed, followed by a period of convalescence and stump shrinkage. When the stump has thus assumed what is to be its permanent state, except for ensuing atrophy, a prosthesis is constructed and fitted, following which the patient is instructed in its use. Thus the chronologic course of events depends upon securing stump healing.

Open stump management

In order to support and stimulate stump healing, every attempt was made to consider all of the factors involved and secure the optimal conditions for wound repair.

General supportive measures

Amputees received a full and adequate diet, supported by vitamin therapy as indicated. Most of the patients gained weight, but care was taken to avoid excessive weight gain, lest it not only interfere with healing, but also tend to reduce the eventual efficiency of prosthetic action. During the early phases of hospitalization, enforced bed rest frequently was used to minimize stump activity and promote healing. Associated injuries and concomitant diseases were given adequate attention and specialized care. This attention was particularly needed in open stump amputees with associated osteomyelitic lesions, in order to maintain the fullest function of the complete but infected extremity. Narcotics and sedatives were used sparingly as needed. In each amputee ward, an athletic specialist directed a program of general bodily exercise, and supervised individualized corrective exercises where indicated.

Specialized supportive measures

If needed, blood and plasma infusions were used. If an open stump was infected, or if there was an associated pyogenic infection, penicillin was administered until the acute process subsided.

Skin traction

Skin traction was employed as long as it was of value. The mechanical pull on the soft tissues unquestionably promotes healing; however this effect is reduced when the soft tissues become firmly fixed with a heavy scar about the periphery of the bone end, as shown in figure 1. Traction applied after fixation continues to be of value, for it maintains at least partial immobilization of the stump and at the same time mobilizes the skin, which will later facilitate revision.



1. Short below-knee stump with heavy fixed terminal scar.

Skin traction was accomplished principally by means of moleskin or stockinet. The former supplies its own adherent surface and is used as anterior and posterior strips, 3 to 4 inches in width, while stockinet requires impregnation with Unna's paste or adhesive paste to provide skin adherence.

On the open stump, stockinet traction proved to be the most useful, since it exerts equal peripheral force on all sides. Snug elastic bandages were applied over the traction material to provide greater purchase on the skin and hold the wound dressing in place. Traction was attached to the protruding fabric by means of pulley weights for those patients in bed. If traction was desired in the ambulatory patient who carried his stump in a dependent position, the weight was tied directly to the fabric. For upper extremities, we used from 2 to 5 pounds of weight, and from 3 to 10 pounds for lower limb stumps, depending upon the amount of pull desired and varying with the recumbent or ambulatory status.

A great variety of local measures were employed to stimulate stump healing. These have been evaluated in terms of controls and experience. For the sake of completeness and brevity, the agents used will be mentioned and those of merit discussed.

Wound cultures

Obviously these open stumps weep nutritive juices which offer support to any microorganism that may come in contact with the surface. What role these bacteria play in inhibiting healing cannot be determined. The bacterial flora is typical of that found in chronic wounds, being essentially saprophytic. The usual organisms include the following in order of frequency: *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Bacillus subtilis*, *Proteus vulgaris*, non-hemolytic streptococci, *Streptococcus pyogenes*, *Str. faecalis*, and rarely clostridia and *Gaffkya tetragena*. As will be observed, many of the local measures used have as their intended purpose the elimination of certain organisms.

Frequency of dressings

Because of the irritating and malodorous nature of open-stump drainage, dressings were changed every day or every 2 or 3 days. More infrequent changes were made as healing progressed. Adequate sterile technic was employed in well-organized dressing rooms. A record of each patient's treatment and progress was kept by the dressing-room crew, who applied the routine dressings. The more elaborate or unusual forms of local therapy were applied by the medical officer in attendance.

Dry dressings

The simple, dry, sterile, fine mesh gauze dressing was used as the fundamental or basic dressing. In approximately one-third of the stumps this appeared to be the dressing of choice, although healing was seldom rapid. Dry dressings tended to reduce the amount of purulent exudate, probably because of their drying effect. This dressing was particularly useful in those stumps with a denuded area at the bottom of a fold or crevice.

Gauze impregnated with ointments

Vaseline, 20-percent zinc oxide ointment, and xeroform gauze were used extensively. The latter seemed preferable because it produced less maceration and provided the maximum of comfort. No particular medicinal or stimulating effect was noted with any of the three.

Ointments and pastes

Greasy dressings were not found to be useful on open stumps. Ointments used included 20-percent zinc oxide, various sulfonamide preparations, penicillin ointments and chlorophyl in carbowax. These

preparations often macerated the wound surface and made it appear indurated. Blood paste was found to be of some value in a few cases. It was probably the only useful one of this group.

Wet dressings

Moist dressings were most useful in cleansing the surface of open stump wounds and therefore were used in preparing them for grafting. As to particular merit displayed by any one of them, little can be said. In fact, 2.5- to 5-percent sodium chloride solutions were as effective as any of the others. Penicillin solutions in strengths varying from 250 to 500 units per cubic centimeter were tried. Cultures after 48 hours of treatment usually revealed disappearance of the gram-positive cocci, but the gram-negative bacilli seemed more abundant. Gram-positive cocci tended to reappear 24 hours after treatment was stopped.

Chlorophyl solution, diluted as recommended, was used in 10 cases, 5 of which appeared improved, in that the wound surface was cleaner. But in two patients the material was highly irritating to the skin, producing an indurated area of acute cellulitis. One of these patients demonstrated lymphangitis and lymphadenitis with an associated fever that reached 103.4° Fahrenheit.

Dakin's solution was used sparingly, but may deserve a more adequate trial. Its tendency to produce skin irritation made us disinclined to use it. Azochloramid, on the other hand, was used in at least 50 cases with highly variable results. It did not appear to be irritating and was successful in cleaning the surface of many of the dirty wounds.

Streptomycin solution in concentration of 1,000 units per cubic centimeter was used on 37 open stumps. This material, being particularly effective against gram-negative bacilli, was employed to rid the stumps of *Pseudomonas aeruginosa*. It was felt that these organisms were responsible for the loss of many stump skin grafts. The solution was used as a moist dressing for 24 to 72 hours before grafting. Cultures were taken before therapy in all 37, and after therapy in 14 cases, by scraping the wound surface vigorously with a knife blade and dropping the accumulated material directly into nutrient broth, from which immediate plate cultures were made. These cultures revealed that *Ps. aeruginosa* disappeared in 13 out of 14 cases in which it was present. However these organisms quickly reappeared when treatment was discontinued and were invariably present at the first skin-graft dressing as demonstrated both by culture and the color of the drainage.

The "take" of skin grafts did not seem to be significantly improved, although the results with streptomycin, where pyocyaneus was pres-

ent, were equally as good as in the non-pyocyanus control group of 10 cases. It could be stated simply that streptomycin tended to eliminate the gram-negative bacilli but did not significantly alter the process of healing. The solution was found useful in preparing the wound surface for grafting.

Special types of dressings

Zinc peroxide was used on 71 patients. It proved most useful in cleaning away dirty granulations and preparing the stumps for grafting. Eleven stumps appeared to heal significantly with this locally applied water-suspended medicament. While zinc peroxide may possess certain bactericidal or bacteriostatic qualities for gram-positive cocci, it was of little value in controlling gram-negative bacilli, especially those whose activity is not altered by alkalinity. Zinc peroxide did, however, produce exudation which tended to reduce edema, flatten granulations and cleanse the wound surface.

Castellani's paint, a common fungicide, was used in 43 cases, since fungi are common inhabitants of indolent wound surfaces. This preparation contains phenol as one of its active ingredients, which tends to coagulate and dry the wound surface. In 19 cases this paint was used in conjunction with an elastoplast wrapping, which was left in place for 5 to 10 days. This served the same purpose as an Unna's paste boot applied for varicose ulcers, and in 11 of the 19 cases resulted in a marked stimulation of epithelial growth. It was particularly useful in those lesions which had remained open for more than 4 months. Due to skin irritation it was necessary to discontinue the use of Castellani's paint and the elastoplast during the warm weather. Potassium permanganate solution and Scott's solution, which contains acetone, were used with little effect.

Whirlpool bath

Thirty-two patients were given whirlpool bath therapy to their open stumps twice each day. The duration of this therapy varied. The water in the bath was under very little pressure and did not contain salt or other added substances. Five patients complained that this therapy made their stumps tender while 9 were definitely helped, 6 stumps healing within 4 weeks after treatment was begun.

Ultraviolet ray therapy

Eleven patients exposed their open stumps to ultraviolet rays every other day for variable periods of time. There was no appreciable effect.

OPERATIVE MANAGEMENT

Skin-grafting

A total of 149 skin-grafting procedures were performed. One hundred twenty of these were primary grafts, while 24 patients were skin-grafted a second time and 5 were subjected to a third grafting procedure. In addition, 1 patient had 4, another 5, and two 6 skin-graft procedures. These included flap and tube full-thickness grafts. The preliminary grafts were either of the split-thickness free-graft type, or Reverdin pinch. In table 1 are presented the results of the 149 grafts. The actual technic of grafting varied considerably. In some instances the free grafts were stitched in place, while in others they were held on by gauze glued or taped to the surrounding skin edges. Compression bandages were used in approximately two-thirds of the cases, while an open technic was utilized in the remaining third. Compression was obtained principally with elastic bandages, while the open method was accomplished by encasing the stump in plaster to which was fastened a plaster or wire cage over the stump end. In these the effect of drying often seemed helpful, as well as the frequent rolling of the grafted area with cotton swabs to maintain close approximation of the graft.

TABLE 1.—*Results of 149 skin grafts*

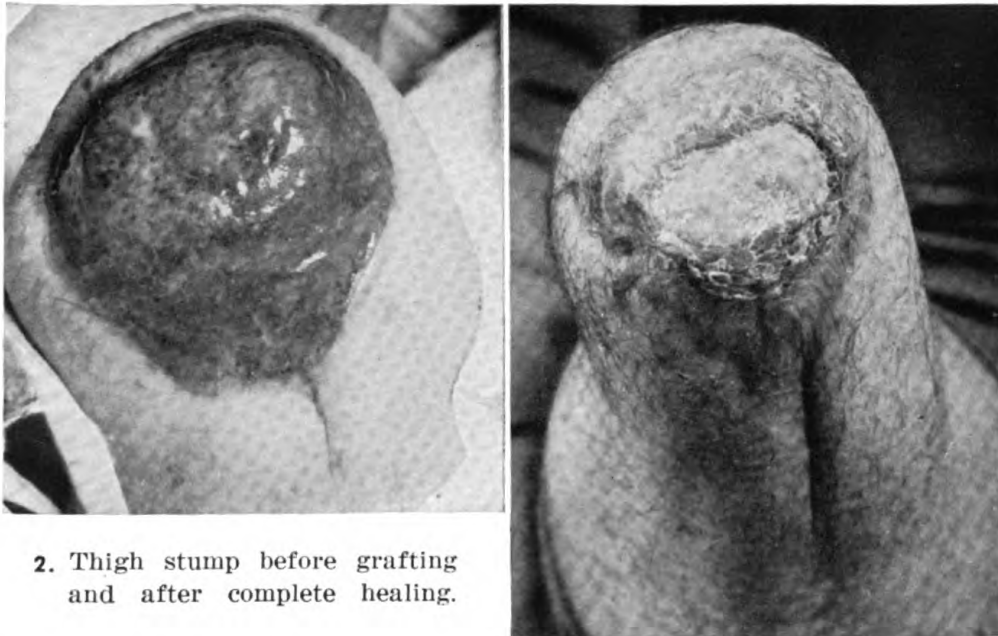
Percent of "take"	Fingers	Partial hand	Fore-arm	Arm	Toes	Partial foot	Below knee	Thigh	Totals
0.....	0	0	0	0	0	4	31	14	49
1-49.....	0	0	1	0	0	1	8	14	24
50-79.....	0	1	1	3	0	3	9	11	28
80-100.....	1	2	2	2	2	11	11	17	48
Totals.....	1	3	4	5	2	19*	59*	56*	149

*29 repeated grafts included in these 3 groups.

After the application of a successful skin graft, healing was usually prompt, followed by a period of rapid contracture. The residual scar, however, was somewhat larger than in those stumps which healed spontaneously. The pregrafting and final healed features are shown in figure 2.

Sinus tract exploration

Stumps which presented draining sinuses were treated conservatively for 2 to 8 weeks, during which time the majority of them healed spontaneously. If healing did not take place in a reasonable period of time, and if there was no evidence of osteomyelitis, the sinus was explored. This was done in seven cases. In several in-



2. Thigh stump before grafting and after complete healing.

stances the sinus tract was first injected with a radiopaque oil so that its course could be determined by x-ray study. This was particularly helpful in determining if the tract communicated with the bone. At exploration the sinus was injected with methylene blue, and then the tract was opened widely and all stained tissue removed. Non-metallic foreign bodies or heavy, dense, fibrotic tissues were usually discovered. Metallic fragments which were present in a great many stumps were seldom found to be the cause of prolonged drainage. Materials such as cloth, leather, gravel, and wood were the most commonly discovered irritating bodies, having been blown into the tissues by explosive force, or carried in by jagged bits of metal. Heavy silk sutures were removed from five stumps.

Sequestrectomy

Stump osteomyelitis occurred in 37 cases, requiring a total of 27 sequestrectomies. It seems strange that the incidence of bony infections should be so low in these open stumps. The principal causes of osteomyelitis were as follows, in order of frequency: Amputation through a site of fracture; infected closed stumps; and elevation of the periosteum proximal to the site of amputation (fig. 3). The mechanism in all three of these was the same; namely, separation of the nutrient periosteum. Healing did not occur as long as necrotic bone remained within the stump. Attempts to remove this bone before complete separation had taken place with the establishment of defense barriers usually resulted in an extension of the process. This occurred



3. Thigh amputation with terminal ring sequestrum.

in two patients, one with a thigh amputation, the other with an arm amputation, both of whom lost functional bone length because of early intervention.

In cases of established osteomyelitis, a prolonged course of penicillin therapy was given before and after sequestration, supported by local warm saline soaks if indicated by an acute process.

Open revision and reamputation

If all other means had failed and healing appeared to have reached a point of complete cessation, the open stump could be converted to a fresh guillotine status by excising the terminal scar tissue, freeing the skin edges, and if imperative, reamputating the bone. Following this no attempt was made to secure closure, but traction was applied and continued until the soft tissues were pulled well down and became fixed. This was done in 11 cases, 2 of which had acute but transitory postoperative infections.

Reamputation at a higher level

In eight cases in which stump healing was unduly prolonged, reamputation at a higher level was performed. In six of these postoperative complications occurred, which in two necessitated secondary revisions due to hematoma formation and wound break-down.

Discussion

The multiplicity of methods used in attempting to secure healing in these open stumps is evidence of our inability to master effectively

and efficiently the chronic open stump. Military surgery demands an open-stump technic of amputation. The now classic guillotine amputation fulfills this demand and offers a rapid method so simple in its design that specialized surgical training is not an essential prerequisite. The rationale of the open stump is based upon its proved value in minimizing the threats of serious postamputation complications among casualties with contaminated battle wounds.

At present it does not appear that the demand for an open procedure will be compromised by the use of penicillin or other antibiotic or chemotherapeutic agents now available. While the obvious advantages of the guillotine technic have now become established essentials, there remain the important considerations of open-stump management, which are not so simple, since healing is usually slow and often prolonged, with resultant pathologic disturbances which predispose to reconstructive and functional difficulties.

Selection of site of open-stump amputation

When circumstances demand an open-stump amputation following injury, the level of division should be at the most distal uninvolved portion of the limb. Every attempt should be made to save as much of the limb as possible, since opinions vary not only between surgeons, but also between surgeons and limb-makers as to the levels of greatest functional value. Since open stumps must later be subjected to reconstructive operative procedures, the task of the surgeon preparing these stumps for prosthetic function is greatly relieved if some latitude in final stump length is possible.

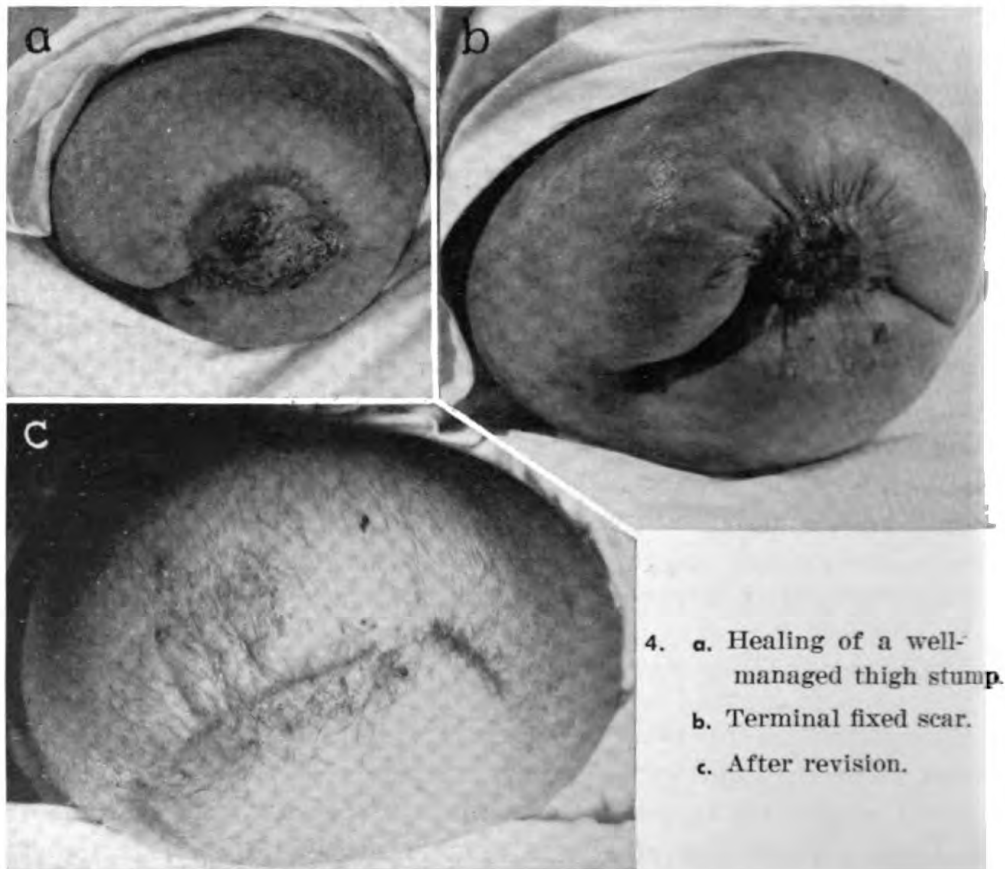
Moreover specialized procedures such as end weight-bearing amputations are impossible if essential structures such as heel pads, patellas and tendons have been sacrificed primarily. Although amputations through or near sites of wounding offer certain potential difficulties, still the useless removal of healthy tissue is to be condemned. This is especially true now that penicillin is available. While final proof is lacking which would establish the fact that useless sacrifice of length has occurred, still the statements of patients, and the stumps themselves strongly suggest that primary conservatism did not always prevail in the 759 posttraumatic amputees seen at this hospital.

Guillotine technic

The guillotine operation is largely explained by its descriptive name. The skin and subcutaneous tissue are divided by an incision carried completely around the circumference of the limb. Following this, and without dissection, the skin is allowed to retract. At the most proximal level of retraction, the fascia is incised in the same

manner as was the skin. Again a circumferential incision is made and carried through the muscle mass down to the periosteum.

In the division of the muscles, the large vessels and principal nerves should be isolated, the former being ligated at the cut muscle surface and the latter transected with a sharp blade at the same level. Following this the soft tissue mass is allowed to retract and the periosteum is incised around the bone at the muscle level. Through this incision the bone is divided without reflecting the nutrient periosteum in either direction. There then remains a concave terminal wound in the center of which the bone is exposed. This surgical operation in all of its simplicity ends with the application of an adequate and comfortable dressing. However, this is but a part of the guillotine technic, for any open amputation presupposes that some form of soft tissue traction or fixation will be employed. From our observation, we feel that *proper skin traction is the most important and most frequently neglected feature of the guillotine technic*. While the operative procedure may be flawless, if it is followed by inadequate, inconstant or omitted soft tissue traction, the end result of primary healing will be unsatisfactory.



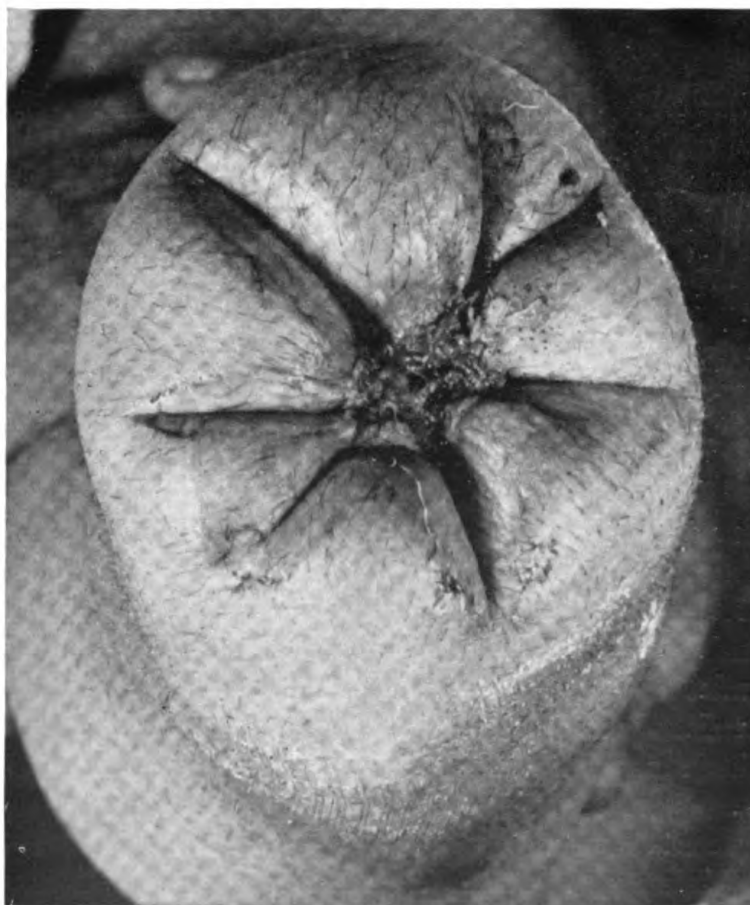
4. a. Healing of a well-managed thigh stump.
b. Terminal fixed scar.
c. After revision.

Healing in the well-managed guillotine stump

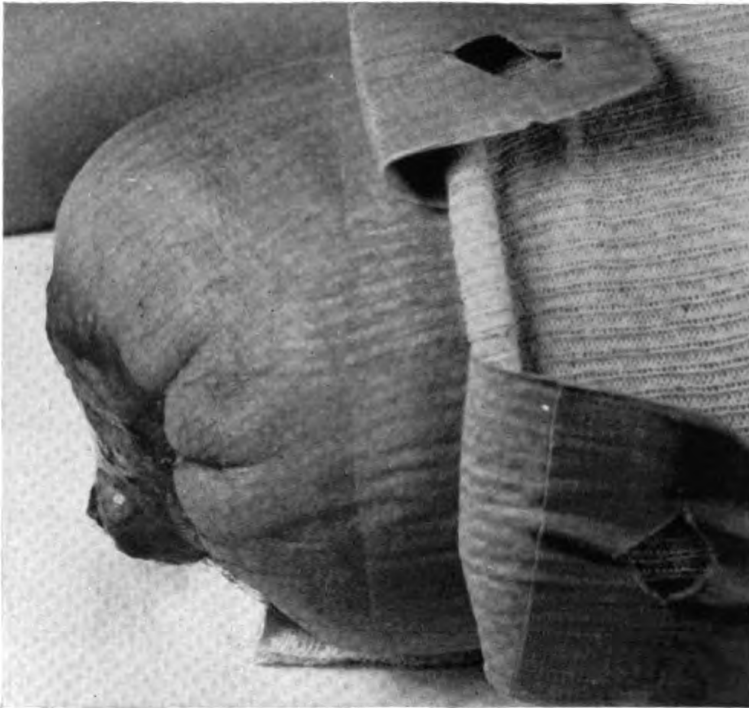
If suitable traction is applied promptly after amputation, the soft tissue will tend to furl inward toward the bony stump, as shown in figures 4a and 5. After a few days the force of mechanical skin traction is augmented by the natural forces of wound contracture, thus bringing the terminal skin edge toward the bone end where it becomes fixed by thick scar. When final healing occurs, there remains a small circular nonmobile scar with radiating folds extending out into the infurled mounds of surrounding soft tissue (fig. 4b). A stump that heals in this manner may be revised with ease and without sacrificing additional bone length by excising the scar, undermining the skin flaps, and closing the stump with a minimum of tension (fig. 4c).

Effects of inadequate traction and prolonged healing time

Since amputation entails ligation of the principal arteries at or above the level of bone transection, thrombosis occurs proximally, so



5. Healing below-knee stump, showing effect of good traction.



6. Thigh stump with protruding bone—the result of inadequate traction.

that collateral blood supply to the soft tissue of the stump end must be established. Such an event must reduce the blood supply to the distal tissues, at least temporarily if not permanently. If stump healing is prolonged because of inadequate soft tissue traction, the normal bodily response is to stimulate fibroblastic tissue formation. This elastic fibrous tissue tends to contract and loses its elasticity, thus further embarrassing the blood supply. With this process of contracture, the skin and its underlying soft tissues are drawn to the periphery of the bony stump which may even protrude beyond the soft tissue if traction has been grossly inadequate, as seen in figure 6.

The bone end, being essentially bloodless on its surface, is slowly covered with a fibrous pad which proliferates from the surrounding soft tissue. While epithelium may slowly creep out upon this tough ischemic surface, it usually comes to an abrupt halt after $\frac{1}{8}$ to $\frac{1}{2}$ inch of growth (fig. 1). Thus all of the pathologic features of an indolent ulcer are present. These chronic lesions present a tough surface covered with pale dirty granulations, below which white scar tissue may extend for a half-inch. This surface oozes serum which offers ample nutriment for any microorganism which might come in contact with it.

This process of healing constitutes a natural defense barrier which substitutes for dermis in protecting the host against environmental

factors which might produce striking systemic disturbances. While the amputees with chronic stump ulcers appear vigorous and active and usually tend to gain weight, there is little doubt that their smoldering open lesions exert upon them systemic disturbances so slight as to escape clinical detection. When continued over weeks and months, this accumulation of systemic trauma must result in irreparable damage which cannot be evaluated.

Flap-open amputation

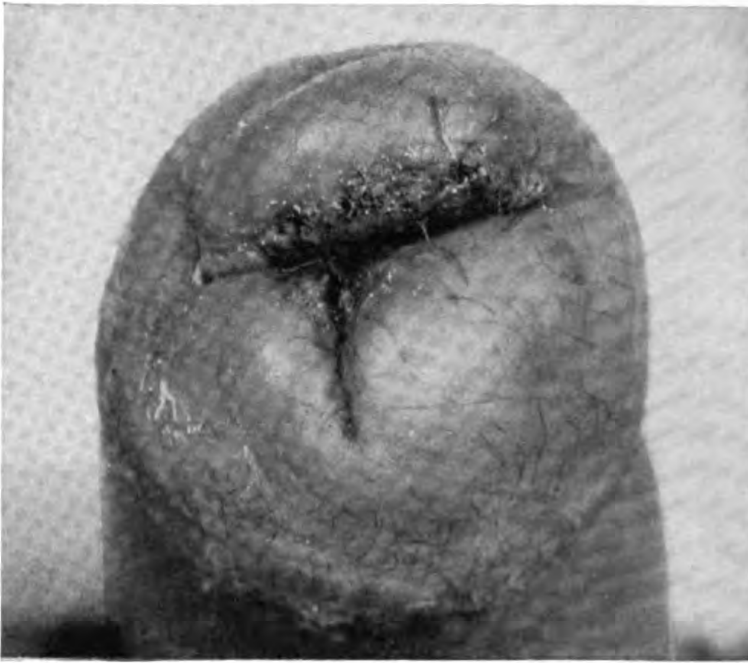
Among the 829 amputations seen here, 45 have been classified as primary flap-open procedures. In only 30 of these were the flaps considered adequate to cover the stump end, while the remaining 15 presented partial or inadequate flaps. We have found these flaps to be of immense value in securing healing and in the final revision or reamputation. Therefore we wish to put forth the plea based on our experience, to save the available skin and fascia wherever possible.

Flap-open amputations offer all of the advantages of the guillotine technic and in addition will save between 1 and 2 months' time in spontaneous healing. In such stumps it is also possible to perform early secondary closure with a minimum of danger from 1 to 2 weeks after amputation. This was done in 3 cases seen here, none of which required further surgery. Among the 45 flap amputations, 25 of them healed spontaneously, 3 so satisfactorily that revision was deemed inadvisable.

Technic of flap-open amputation

The flap-open amputation, performed here in four cases of primary amputation, differs from the classic guillotine procedure only in skin and fascial incisions. Instead of a single circumferential incision through these structures, incisions are started from a V-nick in the midlateral plane and carried distally to the midanterior and posterior planes, from which point they are curved proximally to the opposite midlateral plane. This provides anterior and posterior half-circle flaps. After the skin has been cut through and allowed to retract, the fascia is incised in the same manner at the skin edge. Following this the skin and the attached fascial flaps are turned back and the muscle, vessels, nerves, and bone divided as described in the guillotine procedure.

Thus the level of bone transection is at, or just proximal to, the lateral corners of the skin wound. These corners offer excellent points of drainage. This amputation should not be used if acute anaerobic infection is the indication for amputation or if the formation of flaps would in any way necessitate amputating the bone at a higher level.



7. Healing below-knee flap-open amputation.

This procedure does not alter the demand for open-stump skin traction, which should be applied immediately by means of anterior and posterior strips of adhesive tape or moleskin. With traction applied in this manner, the skin flaps tend to fall together and heal, as shown in figure 7. If a delay in healing is desired, the flaps may be held apart temporarily by vaseline or fine-mesh gauze.

It is our opinion that had it been possible to use the flap-open technic in all 570 cases of guillotine amputations, at least an average of 4 weeks would have been saved in each, which would amount to a total saving of 15,960 man-days of hospitalization.

Healing time

In table 2 is presented the average spontaneous and post-skin-graft healing times of guillotine and flap-open amputations. At the present time, 148 stumps remain unhealed among the 420 stumps which were unhealed or presented draining sinuses on admission. One of these has been open for 15 months, another for 16, and the longest for 27 months.

Healing time and level of amputation

Open amputations of arms and forearms are seldom troublesome. Very few of these require skin-grafting, since healing is rapid. Why these stumps are so distinguished from those of corresponding levels

TABLE 2.—*Healing time in guillotine and flap-open amputations*

HEALED GUILLOTINE AMPUTATIONS					
	No.	Spontaneous	Average No. months	Following skin grafts	Average No. months
Fingers.....	6	4	2.5	2	2.0
Partial hand.....	8	6	4.2	2	3.5
Forearm.....	37	34	2.3	3	2.8
Arm.....	74	64	2.6	10	3.9
Toes.....	14	11	2.4	3	2.7
Partial foot.....	12	4	5.6	8	7.7
Leg.....	67	44	3.4	23	5.1
Thigh.....	146	104	4.4	42	4.7
Totals.....	364	271	3.5	93	4.7

HEALED FLAP-OPEN AMPUTATIONS					
	No.	Spontaneous	Average No. months	Following skin grafts	Average No. months
Fingers.....	0	0	0	0	0
Partial hand.....	0	0	0	0	0
Forearm.....	5	5	1.5	0	0
Arm.....	6	6	3.3	0	0
Toes.....	0	0	0	0	0
Partial foot.....	2	2	6.2	0	0
Leg.....	7	6	1.7	1	5
Thigh.....	9	7	2.6	2	3
Totals.....	29	26	2.6	3	3.7

of the lower extremity is not fully understood, but may be due to a better blood supply, a natural soft tissue redundancy and a higher degree of inactivity or immobilization during convalescence. Experience has shown that partial hand and finger amputations should be closed primarily if possible, even to the extent of using free pedicle or tube grafts in order to secure complete covering.

Since the hand or any remaining part of it may serve a useful function, it is imperative that vital tendon, nerve, and bone structure be covered to preserve their functional integrity. If healing is delayed in these cases, a stiff hand with little functional value will result. Prompt closure or coverage, early activity and physiotherapy are the essentials of good traumatic hand surgery. An abundance of fibrous tissue in a useless claw dooms even the best of plastic reconstructive attempts to negligible improvements.

Toe amputations often heal slowly, but usually do not result in significant functional loss. Closure here is not a prerequisite as in fingers, for the functional loss is slight and in many instances further surgical procedures are not required after healing has been secured.

Partial foot amputations present the gravest healing problems of all levels. While it is unquestionably advantageous to preserve these normal weight-bearing structures, their care is prolonged and tedious. If, at primary amputation, skin flaps were not preserved or closure performed, spontaneous healing is almost certain not to occur in any

reasonable period of time. This is especially true if the amputation site is proximal to the midtarsal level. Not only is healing difficult or impossible to obtain, but if it does occur, the scar will not withstand the trauma of walking. It is, therefore, necessary to appeal to the plastic surgeon to apply full-thickness, durable grafts to these open or thinly healed areas. An additional complication frequently seen in these patients is Achilles tendon contracture with a resultant deformity that often necessitates fixation of the ankle joint.

Below-knee and thigh amputations were by far the most common, occurring in 413 of the 615 open amputations. These stumps are not only the most common, but present the greatest individual problems, other than partial foot amputations. This is well supported by the fact that 127 of the leg and thigh stumps still remain open.

SUMMARY

Seven hundred sixty-nine amputees with 829 amputation stumps were admitted to this hospital. Six hundred fifteen of the primary amputations were left open, 570 of which were classified as guillotine and 45 as flap-open. Upon admission, 387 of the open stumps were unhealed, 148 of which are still unhealed. It was our policy to await complete healing before performing any final operative procedures. Because of this the problem of stump healing became our greatest obstacle, since healing is slow and often prolonged. A complete program of supportive and local management was followed in attempting to promote healing. Various local agents were used to promote stump healing or prepare the wound surfaces for grafting. The most useful agents included hypertonic saline solutions, zinc peroxide, streptomycin, penicillin, and azochloramid.

Skin-grafting appeared to be the most beneficial form of treatment. The results of 149 stump skin grafts are presented. Osteomyelitis occurred in 37 of the open-type stumps and was usually attributed to traumatic, infectious, or surgical elevation of the periosteum. Open-stump healing results in excessive fibrosis and ischemia, thus inhibiting the natural forces of repair. Inadequate or improper skin traction was the principal explanation for the healing difficulties encountered. It appears that healing would have been facilitated by the presence of skin flaps which are sacrificed in following the guillotine technic.

It is estimated that stump healing time would have been shortened by at least 1 month if flap-open amputations had been performed. A plea is therefore made to perform open amputations at the most distal point of viability, to apply adequate and continuous traction, and to save available skin and fascia flaps wherever possible to promote healing.

IV. PROBLEMS OF REVISION AND REAMPUTATION

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When this hospital was designated as a rehabilitation facility for amputees, it became the policy to transfer such patients here from other Naval hospitals as soon as travel no longer constituted a hazard to uninterrupted healing. As a result, patients on arrival presented all stages of progress from that of an open guillotine stump only 8 days postoperative to that of a well-healed stump ready and satisfactory for the fitting of a prosthesis. Of the 829 stumps in 769 patients admitted here, 274 were healed and ready for a prosthesis. The remaining 555 were open or required further surgical treatment.

In the preceding article the management of the open guillotine stump was discussed. Additional operative measures were required in a considerable number of patients. We have grouped them under two headings: (1) Revisions, including operations on the stump to secure closure with normal skin, plastic procedures to eliminate minor soft-tissue defects, and the excision of painful neuromas; and (2) reamputations, in which the stump had to be shortened by bone removal. In this article experiences with 205 revisions in 197 patients are discussed, and with 88 reamputations in 88 patients. They are grouped according to the final level of amputation.

REVISION

General considerations

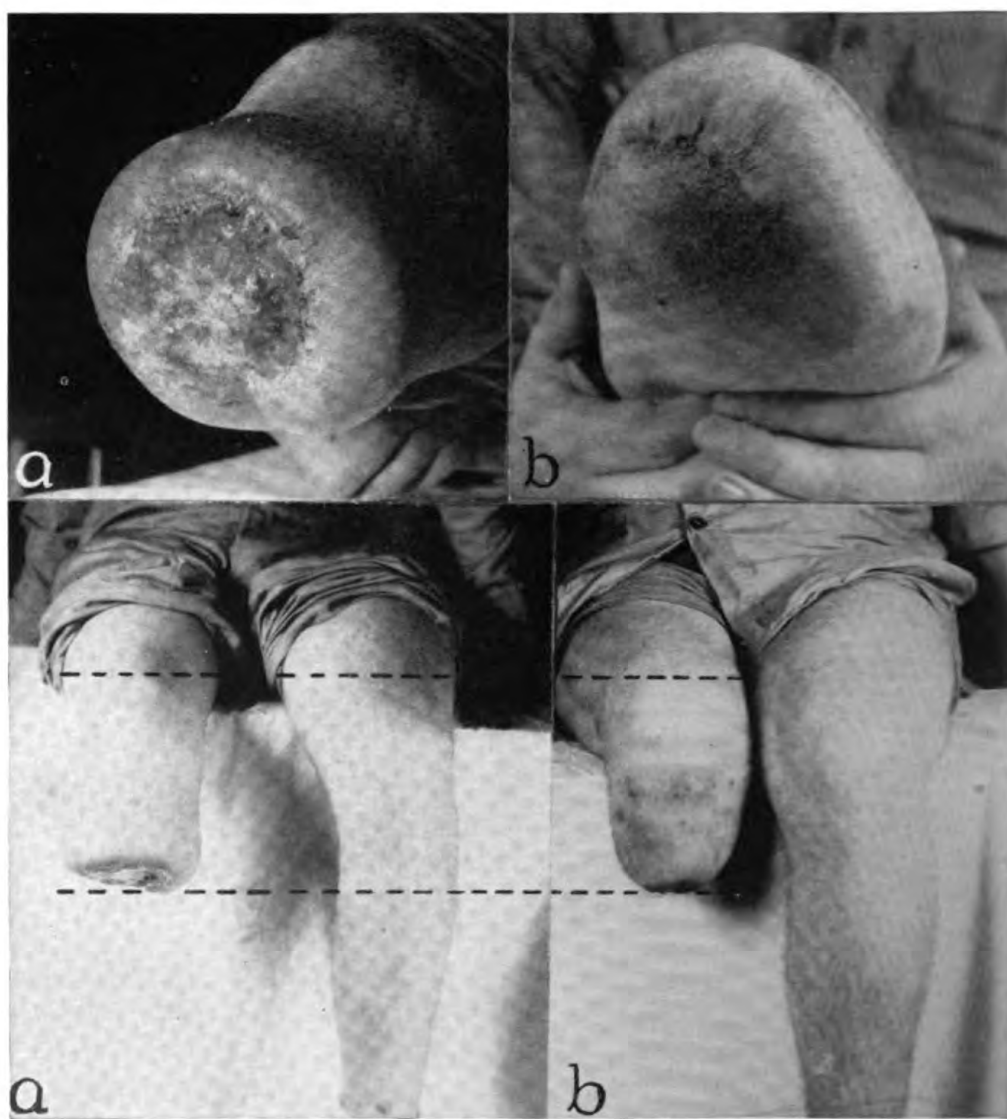
At this amputation center no revision is performed through an open stump unless all measures to secure healing have failed. It has been claimed by some that, in the absence of active inflammation, with sterile cultures and with the use of penicillin, it is safe to perform soft-tissue closure of the amputation stump. In our experience few such cases were successful because of complications ranging from adherent scars to serious postoperative inflammation.

Prior to a "revision," each patient was carefully examined for painful neuroma or phantom pain. In cases with neuromas, painful or adherent to the scar, and in cases with phantom pain, the nerves were divided at a higher level. If the patient was asymptomatic and

the nerve ends were not adherent to the scar, no attempt was made to isolate them.

The majority of revisions involved only minor plastic repair, consisting of excision of scar tissue and closure by subcutaneous tissue and skin. Fascial closure was neither possible nor attempted, except in cases with marked redundancy of soft tissue. These cases did not constitute any serious problem if skin closure could be secured without tension. In leg amputations it was usually necessary to bevel the tibia and divide the fibula at a higher level.

Another group of cases were those with inadequate skin to secure closure, in which sacrifice of any stump length would have meant



1. **a.** High amputation below knee. Complete healing could not be obtained with repeated skin grafts. Revision performed with an open stump and resultant adherent scar. **b.** Final appearance after secondary revision and without sacrifice of bone length.

serious functional loss to the patient. This was frequently found in patients with the vertical guillotine type of amputation, particularly where skin traction had not been properly applied. It is our opinion that an open-flap amputation could have been performed as a primary procedure in the majority of these cases, vertical guillotine amputation being performed only in cases with anaerobic infection.

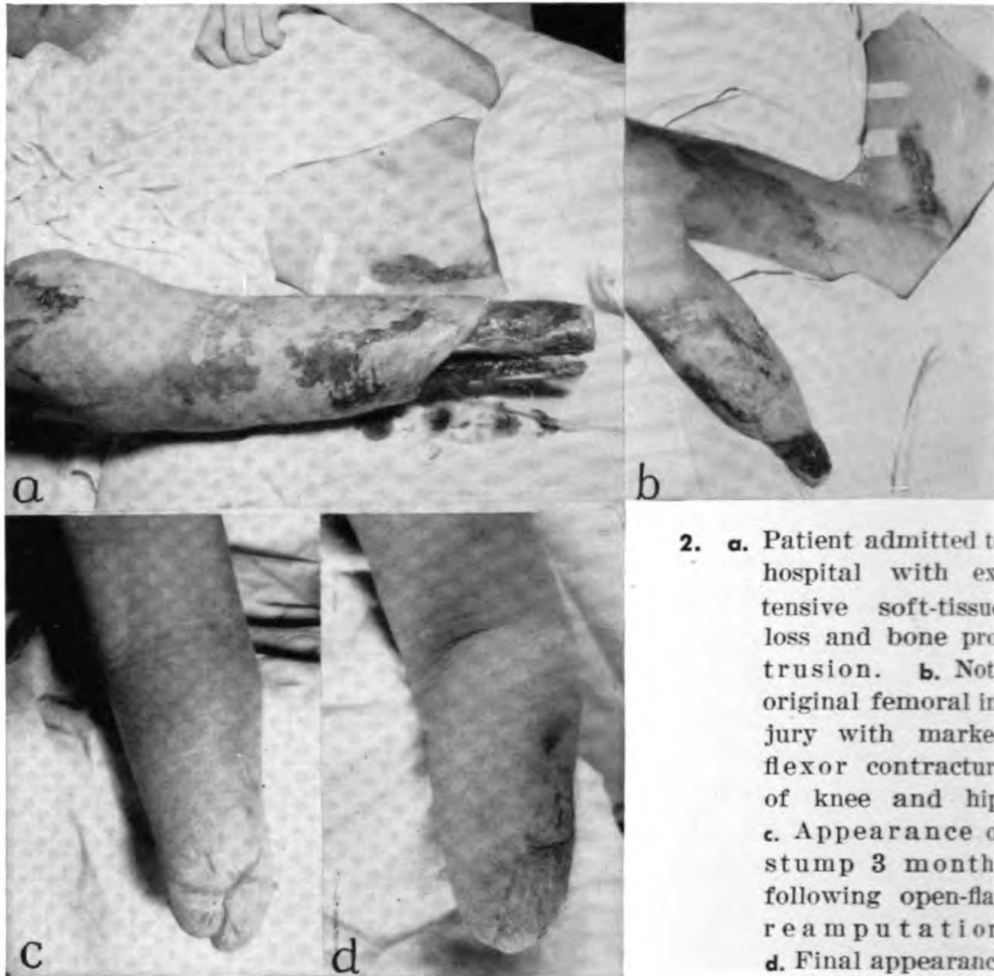
Some of the patients with guillotine amputations improved with continuous skin traction so that closure could be effected, but others required a two-stage revision. This was performed by incising the skin at the margin of the scar and undermining it to secure further skin relaxation. The skin was then brought down over the scar in order to determine the amount of scar that could be excised to secure loose skin closure. This portion of the scar was removed and the skin was then sutured to the margin of the remaining scar. By advancement of skin and subcutaneous tissue in this manner, closure could usually be obtained in the second stage with no resultant functional loss of the stump (fig. 1).

Another type of stump that at times required two-stage revision was one in which the terminal amputation had a longitudinal or T-type scar. When the longitudinal component was short and had adequate skin, it could be excised with the terminal scar and revision could be completed in one operation. When the longitudinal scar was long, it was disregarded in the closure of the terminal flap. However, this usually causes a furrow after shrinking and may later require a simple plastic procedure. Many scars could not be placed in the best position and had to be closed laterally, obliquely, or over bone end. A drain was usually required for the first 48 hours post-operatively. Traction was used in all cases of the lower extremity, and in the upper extremity when closure with tension was necessary.

REAMPUTATION

General principles

Reamputation was frequently indicated in war amputees following the proper procedure of primary open amputations done at the most distal level to preserve the maximum length of the extremity. Reamputation may be indicated for these reasons: (1) A short stump that has no functional value; (2) loss of soft tissue with extensive scar replacement that will not endure the pressure of a prosthesis; (3) extensive bone infection in a stump; and (4) after the guillotine amputation, when a lack of soft tissue will not permit closure. There was a small group of patients with a stump that was not ideal but which should be given the test of function with a prosthesis before



2. **a.** Patient admitted to hospital with extensive soft-tissue loss and bone protrusion. **b.** Note original femoral injury with marked flexor contracture of knee and hip. **c.** Appearance of stump 3 months following open-flap reamputation. **d.** Final appearance of stump after minor revision of soft tissue.

deciding to amputate at a higher level. An open-flap reamputation was occasionally indicated in cases with extensive soft-tissue loss and bone protrusion, in an effort to maintain the greatest amount of length of the extremity (fig. 2).

Levels of reamputation

Not all levels of amputation are acceptable. Too long a stump may result in trophic disturbances because of a poor blood supply, or may be unsatisfactory because the patient cannot be fitted with a satisfactory prosthesis. Sites of election for amputation are therefore based on these points: The best functional stump, the proper level for the fitting of a prosthesis, and the least likelihood of delayed complications (figs. 3 and 4). When it has been determined that reamputation is necessary, the question of the next higher level of amputation with the greatest functional value must be decided. There is no unanimity of opinion as to the relative merits of the lateral

weight-bearing stump and the end weight-bearing stump. The Canadians are enthusiastic about end-bearing levels of amputation, the English are not. We in this country have no reliable statistics on a sufficiently large group of patients to substantiate either opinion. Levels of amputation that are not considered acceptable today, because of difficulty in fitting a prosthesis, may soon be considered acceptable, as the result of improvement in artificial limbs.

No amputation should be performed unless it is thought that primary healing will occur. If the proposed level of amputation is close to an open guillotine stump, complete healing of the stump must first occur. If the level is well above the open stump, amputation may be performed before the stump has healed, provided that all active inflammation has subsided.

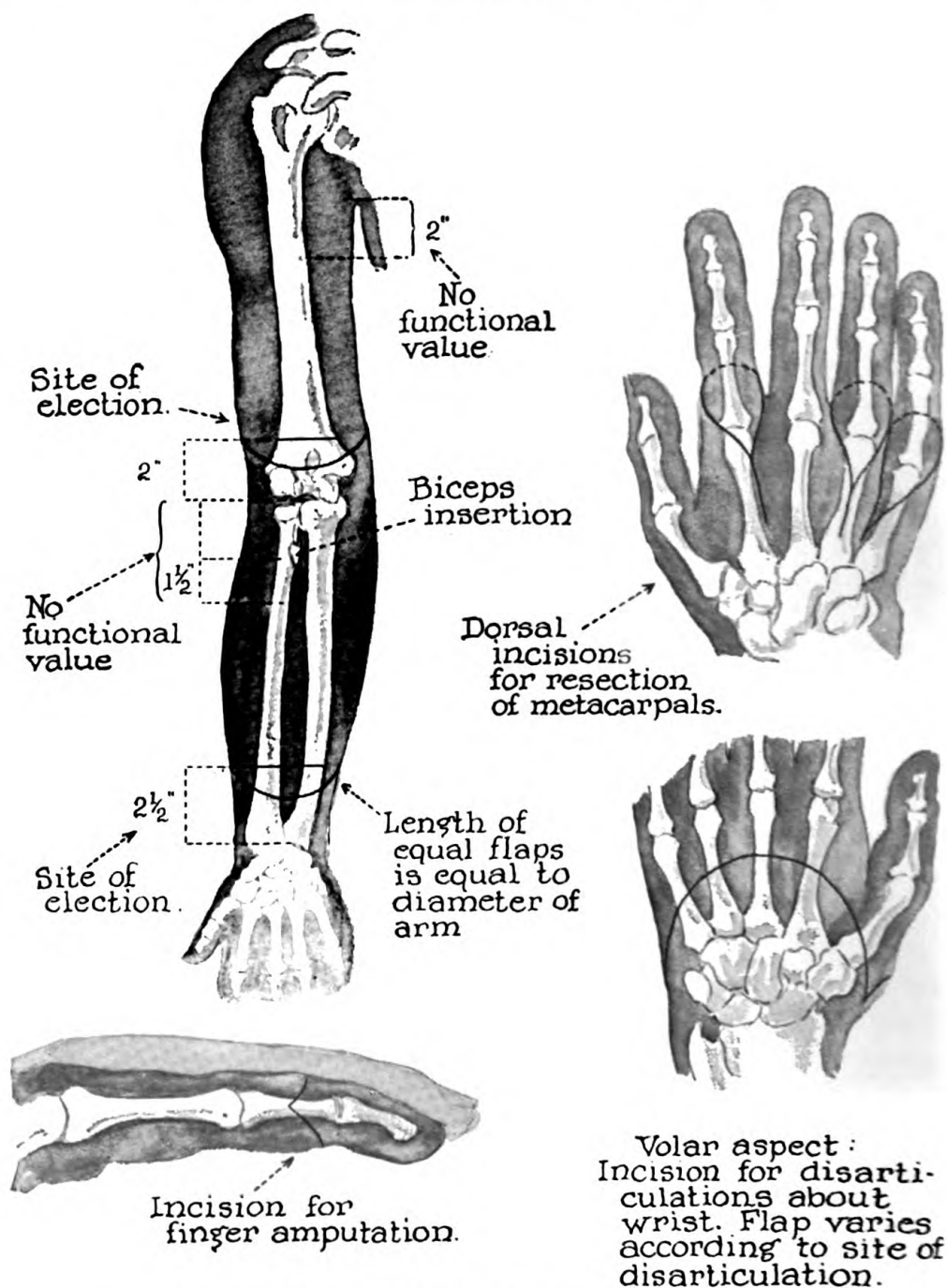
In the technic of all amputations, certain basic principles must be observed in the handling of the different anatomic structures. They deserve a brief statement at this point.

1. *Skin*.—Skin flaps must be tapered so as to prevent the formation of redundant tabs. The flaps must be so shaped that suture lines do not lie over pressure points. Thus, in amputations about the foot, there should be a long plantar flap so that the scar is on the dorsum of the foot. In the lower extremity the anterior flap should be slightly longer than the posterior, so that the scar will not be over bone end. In amputations of the fingers and hands, and in disarticulations about the wrist, long palmar flaps are made so that the scar is on the dorsum of the stump. In the upper extremity, the skin flaps should be of equal size so that the resulting scar will be terminal and no irritation will result from the use of the prosthesis. The combined length of the flaps should be slightly greater than the diameter of the extremity at the site of the amputation; any excess of skin can easily be cut away. It is much better to err by making too long a flap than too short a one, lest skin closure with tension result.

2. *Fascia*.—It has commonly been claimed that skin and subcutaneous tissue are adequate covering for the bone end. We believe that in addition to skin flaps, fascial flaps should be fashioned in the same manner as the skin flaps whenever possible. But the fascial flaps should be of different relative proportions so that the suture line of the fascia and of the skin are not superimposed. Fascia prevents adherence of scar to bone end, gives better lymphatic drainage, and tends to prevent a bulbous stump.

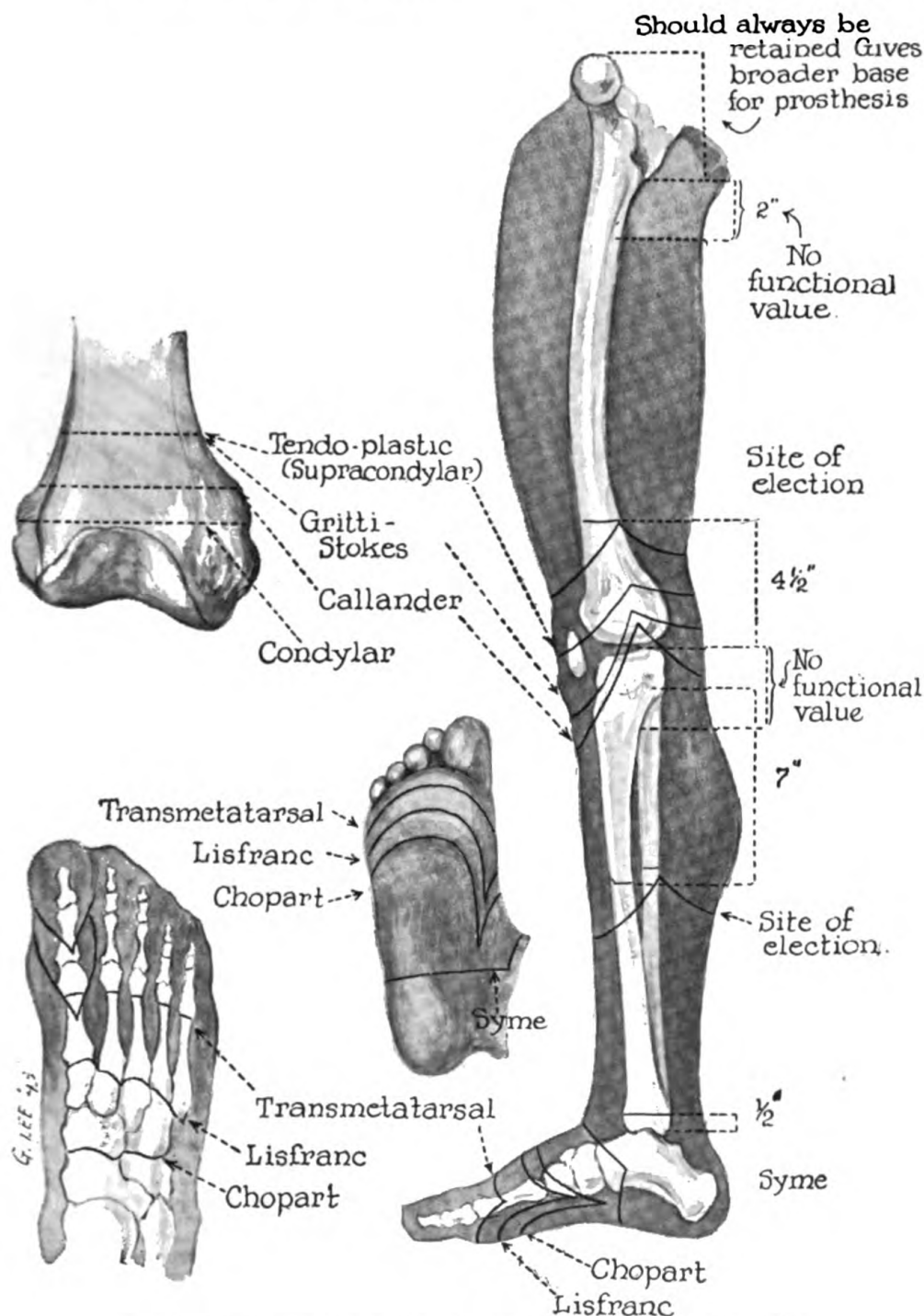
3. *Muscle*.—Muscle is divided at the same level at which the bone section is to be made.

4. *Nerves*.—Nerves are pulled down just enough before being cut to prevent their adherence to the scar tissue at the site of the ampu-



3. Amputation levels with skin incisions. Upper extremity.

tation. A common mistake is to pull the nerve down so far that when it is divided, it retracts to a point where it lies at the level of the pressure of the prosthesis. Nerves should be cut, not ligated. But in the sciatic nerve a blood vessel requiring ligation is frequently found. Every effort is made to separate the vessel from the nerve and to tie it separately. After a nerve is divided it is permitted to



4. Amputation levels with skin incisions. Lower extremity.

retract in its normal fascial plane. In general, nerves are not implanted in muscle or bone, and, with the exception of the digital nerves, are not injected with alcohol.

5. *Blood vessels*.—All major vessels are doubly ligated, or ligated and transfixed and ligated with chromic catgut No. 1. We use only absorbable materials for ligation or buried suturing.

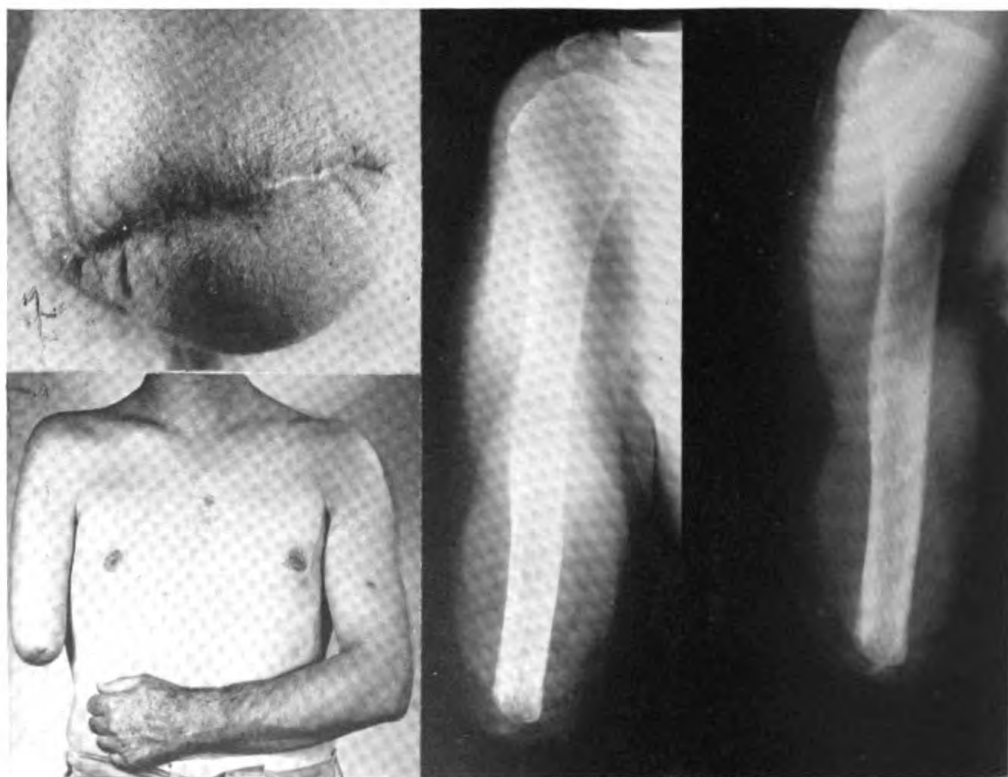
6. *Bone and periosteum.*—The periosteum is divided just above the level at which the bone is to be sawed. The periosteum on the proximal fragment should not be disturbed, lest this lead to bone formation or predispose to osteomyelitis because of bone avascularity. After the bone is sawed, and especially if a rasp is used, the wound should always be irrigated with normal saline solution to remove bone dust.

7. *Wound closure.*—Fascia is closed with interrupted chromic catgut No. 0; subcutaneous tissue with interrupted plain catgut No. 1; skin with interrupted vertical mattress sutures of cotton No. 10 or No. 30.

8. *Drainage.*—Drains should be placed at the angle of the incision and never in the central portion of the incision where the blood supply is the poorest.

9. *Postoperative dressing.*—Dressings should not be applied with compression, as the constrictive effect of the bandage will cause edema of the stump and predispose to a breakdown of the incision.

10. *Postoperative care.*—Five-pound skin traction is always applied to amputation of the lower extremity to prevent contractures and tension on the suture line. Drains are removed in 48 hours and the sutures on the eighth or ninth postoperative day. Stumps should



5. Arm amputation performed at site of election.

always be held in a neutral position. Contractures should be treated by splinting or by skin traction. Recently amputated stumps should be left alone. Any irritation, either by early massage or by use, leads to the formation of more scar tissue. After the incision is completely healed, Ace bandages are applied with pressure directed from below upward to aid in shrinkage and to produce a conical stump. Active motion is started after the second week and is followed by resistive exercises. The patient is measured for his prosthesis (a permanent one; we do not use temporary pylons) about the fifth postoperative week. With the use of the prosthesis, shrinkage of the stump continues, so that the patient usually requires a new bucket before discharge from the hospital.

CLINICAL DATA

The following salient data of our experience in revision and reamputation are based on the 549 patients whose surgical treatment had been completed at the time of this writing. The data have been grouped according to anatomic sites of amputation, with a discussion, for each group, of items of clinical interest and practical importance.

UPPER EXTREMITY

Arm amputations

Of 89 completed arm amputations in 89 patients, 29 were those of patients admitted with a satisfactory stump requiring no further treatment. Of the remaining 60 stumps requiring further surgery, 47 were instances of guillotine amputation; 6 were closed-flap amputations; 3 open-flap amputations; and 4 cases had been revised prior to admission. Of the 44 post-guillotine stumps, 34 required revision, and in 2 instances full-thickness skin grafts to replace terminal scar were performed.

Revisions were performed in 10 additional cases: Four had closed-flap amputations, two had open-flap amputations and four amputations had been revised prior to admission. The indications for revision in this group of cases were adherent scar in four cases, bulbous stumps in five, and painful neuromas in one. Three of the revisions for guillotine amputations were complicated, one by prolonged drainage and two by soft-tissue infection, but none required further surgery. The complications in revisions were 6.8 percent.

Reamputation was necessary in 14 stumps, 11 of which were post-guillotine cases; 2 were closed-flap amputations and 1 an open-flap amputation. Three of these had been forearm amputations at or above the site of insertion of the biceps tendon and had to be con-

verted into arm amputations, one because of osteomyelitis of both bones and two because of an ulna fragment which was too short to receive a bone graft. There were no complications following reamputation.

Following reamputation the average length of the stump was 6.3 inches in those that originally were arm amputations, and 7.5 inches in the three forearm cases that had to be reamputated above the elbow.

Every effort should be made to preserve short forearm stumps, which, even though imperfect, have a greater functional value than stumps above elbow level. The site of election for amputations above the elbow joint is just above the flare of the humeral condyle (fig. 5). At this level the patient has maximal control of his stump, and by amputating the distal end of the humerus sufficient room is given so that the prosthesis can be fitted with proportionate arm length.

The higher the level of arm amputation, the poorer is the control of the prosthesis, until a point is reached approximately 2 inches below the pectoralis major insertion, at which level the patient has practically no control of his prosthetic appliance. The remaining humerus above this level should not be removed, as the cosmetic appearance is better than in those who have suffered a disarticulation of the shoulder joint. Also, in this latter group, it may be possible, by means of skin-tube grafting and bone-grafting to increase the length of the stump. We have two cases in which we are in the process of doing this.

Forearm amputations

Of 71 completed forearm amputations in 69 patients (2 bilateral cases), 36 were on patients admitted with satisfactory stump or stumps. In 25 patients, 26 closed-flap amputations had been performed (1 bilateral case); 9 patients had had revised amputations prior to admission; 1 patient had an open-flap amputation; and 1 had a guillotine amputation, none of whom required further surgery.

Of the remaining 34 amputations in 33 patients, 22 were guillotine amputations which required revision for excision of scar tissue and to secure closure with normal skin. Two of these patients had a soft-tissue breakdown, but required no further surgery. Revision was performed in 4 additional cases, 2 for adherent scars, and 1 for excision of exostosis (in 3 patients who had previous closed-flap amputations) and in 1 case of an open-flap amputation for an adherent scar. There were no complications in this group. The over-all complications in forearm revisions was 7.5 percent.

Eight reamputations were performed. Three of these were in patients admitted with irreparable loss of the hand, two of which

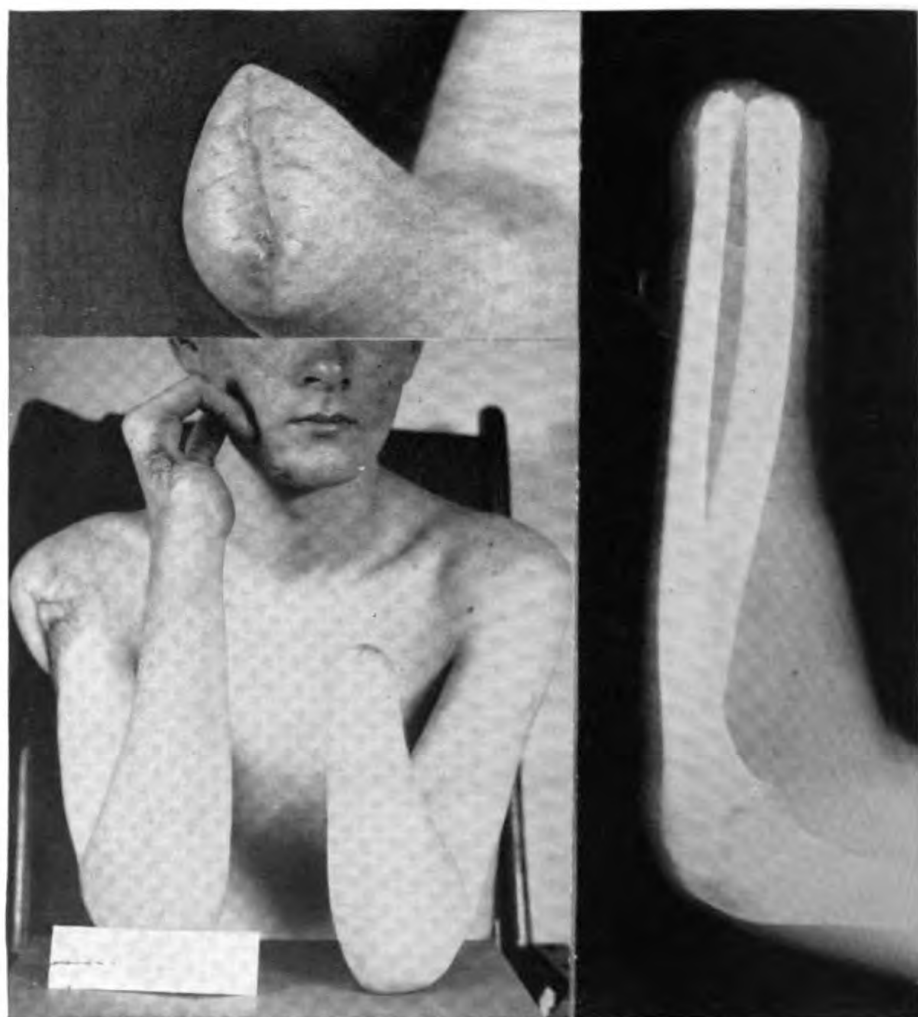
could be converted into an intercarpal disarticulation, and one into a disarticulation of the wrist. Three cases, in two of which the patient had had a guillotine disarticulation of the wrist, and one a closed disarticulation, were converted to forearm amputations, as there was extensive loss of soft tissue in all, and two patients had associated subluxation of the distal radio-ulnar joint. Two required reamputation to secure skin closure in a previously performed guillotine amputation. There were no complications in this group of cases.

6. Photograph and roentgenographs of an intercarpal disarticulation.



The average length of the stump was 7.3 inches in the two cases requiring reamputation of the forearm.

If disarticulation about the wrist joint can be performed, the preferable site is at the carpometacarpal level, as retention of the carpal bones gives increased stability to the distal radio-ulnar joint and good blood supply through the long palmar skin flap. The next desirable level is an intercarpal disarticulation, based on the same anatomic principles (fig. 6). Although disarticulation of the wrist joint has not been considered a good level of amputation, as delayed trophic disturbances are likely to occur, we have made every effort to preserve this level of amputation, as there is greater functional control of the prosthesis by utilizing pronation and supination of the forearm. The site of election for forearm amputations is $2\frac{1}{2}$ inches above the wrist joint (fig. 7). Higher levels give progressively greater functional loss up to a level of $1\frac{1}{2}$ inches below the biceps insertion, above which there is not sufficient stump length to control the prosthesis.



7. Forearm amputation at site of election.

We have performed the cineplastic procedure in five carefully selected cases. These patients should have a minimum stump length of $5\frac{1}{2}$ inches below the biceps insertion, with good muscular development, and a personal desire to have this procedure performed. We have followed the usual technic, except that we do it in two stages. The first stage consists of lifting and resuturing the skin flaps; in the second stage, performed 4 or 5 weeks later, the skin channels are constructed. With the two-stage procedure there is less danger of breakdown of the skin channels.

Phalangization procedures to separate the two forearm bones so that direct pinching or grasping functions are restored to the stump, or operative procedures, as tube skin-grafting and bone-grafting, or transfer of the biceps tendon to the brachialis anticus muscle, so as to give increased stump length, have not been performed in this group of cases.

Partial hand amputations

Of 14 completed cases of partial hand amputations, 11 patients in whom no further surgery was indicated were admitted. Of the remaining three, all of whom had debridement and primary closure, one revision was performed for painful neuromas, a "Z" plastic on the thumb to improve motion was done in the second case, and in the third a full-thickness skin graft was performed to replace a scar. One patient was advised to have a bone graft to a metacarpal, but he refused. No complications resulted in any of these cases.

So many combinations of partial or complete loss of the metacarpals are encountered as to preclude a detailed discussion. With a normal thumb, every effort should be made to restore pinch function, and if a metacarpal or portion of a metacarpal remains, bone-grafting may be performed to the remaining metacarpal to restore this function (fig. 8). In cases with partial loss of the second and third metacarpals, with the rest of the hand intact, these metacarpals should be resected near their bases, keeping the third metacarpal a little longer than the second. This will improve the web and remove projecting ends which are frequently painful and which have no functional value. "Z" plastics on the thumb should be performed in web contractures. Sensitive scars or scars subject to trauma should be excised or replaced by full-thickness skin grafts.

Finger amputations

Of 38 completed cases of finger amputations, 25 patients had 2 or more finger amputations at various levels and 13 had partial or complete loss of only one digit. Thirty-four of these patients had

primary debridement and closure and two had guillotine amputations. Revision was performed in 8 cases, 5 for digital neuromas and 3 for digital neuromas and exostoses. Two primary amputations were per-



8. **a.** Roentgenograph showing bone graft of the distal end of the third metacarpal. **b.** Postoperative result with pinch function improved.

9. Proper level of resection of the second metacarpal.



formed in acute traumatic injuries, both patients having suffered a partial amputation of 1 finger. Reamputation was performed in 3 cases, 2 of which were for resection of metacarpal bone and 1 for a short painful stump. A rotation osteotomy of the first metacarpal was performed in 1 case, and a free full-thickness skin graft for scar replacement of an index finger was done in another case. There were no operative complications in this group.



10. Disarticulation of index and middle fingers at metacarpal joints. Partial or complete resection of intact metacarpals should never be performed.

Every effort should be made to preserve finger length. This is particularly true in the thumb and the index and middle fingers, which are so important in all functions of the hand. The majority of patients who have scar tissue over the stump end should have replacements with full-thickness skin graft rather than bone shortening.

Many combinations of finger amputations are seen, each with its own reconstructive problems. The index finger loses its function of pinch as it gets progressively shorter, and when it is amputated through the proximal phalanx, all of this function is lost. Pinch is then performed by the middle finger. If the patient requires finer use of his hand, the remaining portion of the index finger and corres-

ponding metacarpal near the proximal end should be removed, as the remaining end of the index finger is a detriment rather than a help (fig. 9). But if the patient is a laborer, this amputation should not be done, as grasp is the most important function.

If the index and middle fingers are amputated, but their corresponding metacarpals are intact, the metacarpals should never be shortened, as the loss of grasp will not be compensated for by any other functional improvement (fig. 10). These two metacarpals are very important in stabilization of the normal palmar arch.

Fingers that have been amputated through the proximal phalanges, with resulting short amputation stumps, should not be reamputated, as a poor cosmetic appearance results and function is not improved.

Disarticulation of all fingers through the metacarpal phalangeal joints, or amputations through the proximal end of the proximal phalanges, result in a practically useless hand. Two methods may be used in the treatment of this type of case. The first is that of tube skin-grafting to the area about the distal end of the third metacarpal, followed by resection of the second metacarpal near its base (to increase web), and implantation of a portion of the second meta-



11. a. Roentgenograph after rotation osteotomy and Kirschner wire fixation.
b. Roentgenograph showing end result. Pinch restored by thumb and distal end, second metacarpal.

carpal into the distal end of the third metacarpal. The second method is to perform a rotation osteotomy of the first metacarpal so that pinch is restored by the thumb and distal end of the second metacarpal. Fixation is secured by Kirschner wires in the distal and proximal fragments, which in turn are incorporated in a cast (fig. 11).

With the exception of resection of the second metacarpal in selected cases, all other intact metacarpals should be left alone. Resection of heads of metacarpals in an effort to narrow the palm and give better cosmetic appearance to the hand results in loss of grasp, which is not compensated for by any other improvement.

LOWER EXTREMITY

Thigh amputations

Of 183 completed cases of thigh amputations in 177 patients (6 bilateral cases), 79 stumps were considered satisfactory.

In 58 post-guillotine stumps it was necessary to perform revision for the excision of scar tissue and to secure closure with normal skin. Four of these cases were complicated by prolonged drainage and 2 by soft-tissue breakdown. All of these cases required a secondary revision. In addition, 15 revisions were performed on 8 patients who had had closed amputations at other activities, and 6 were the result of complications in the primary revision at this hospital. In addition, a revision was performed on 1 open-flap reamputation performed at this hospital. The indications for revision in this group of cases were adherence of scar in 5 cases; painful neuromas in three cases; delayed breakdown of scar after use of the prosthesis in 4, and removal of exostoses in 2 cases. One of these patients had a postoperative soft-tissue infection which did not require further surgery. Six additional patients have had revision of their amputations, but these are not considered surgically complete, as 4 were complicated by prolonged drainage, and 2 by soft-tissue breakdown. The incidence of complications in thigh revisions was 17.8 percent.

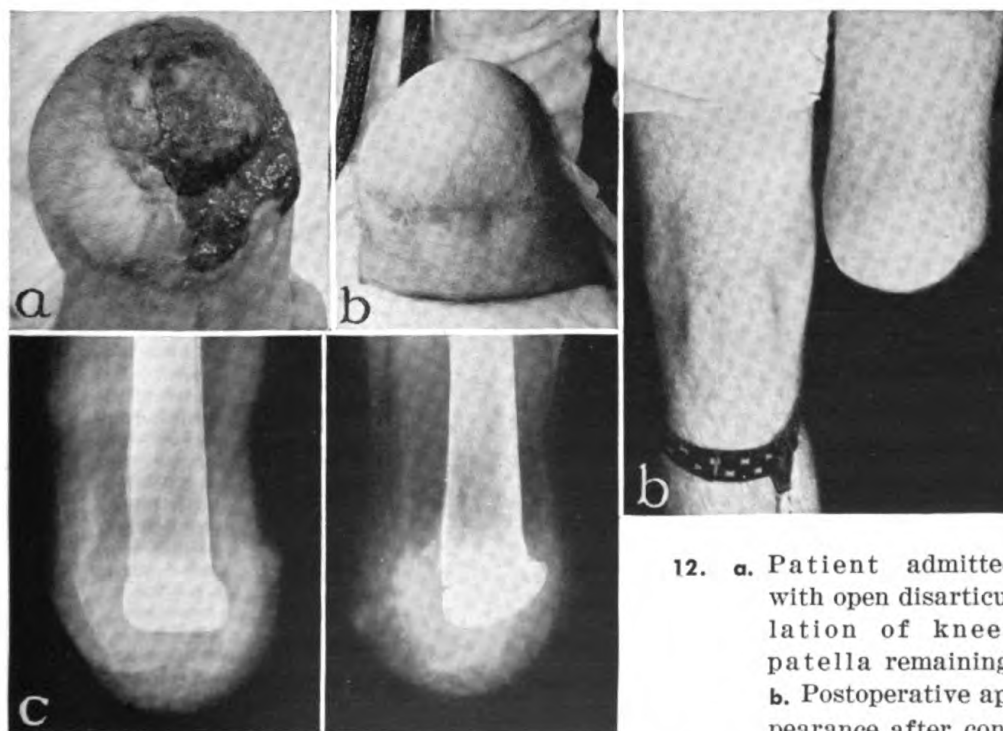
Two primary amputations were performed at this activity for osteogenic sarcoma of the femur. Thirty-five closed reamputations were performed; 21 of these patients had their primary amputation through the distal third of the femur. These reamputations were performed to secure skin closure, or to secure skin closure and shorten the femur so that a prosthesis could be fitted. The Stokes-Gritti procedure was performed in 12 instances; five of these amputations were converted from short, below-knee levels with stumps of no functional value, and in 7 there previously had been an open disarticulation of the knee or low thigh amputation, with an intact patella remaining. Two patients, one with extensive infection of the

stump involving the knee joint, and one with extensive scar from burns, required low thigh amputations, making a total of 7 cases that were converted from below-knee to thigh levels of amputation. One open-flap reamputation, which required subsequent revision, was performed in a case with extensive loss of soft tissue and with bone protrusion.

The average length of stump in thigh reamputations (excluding the Stokes-Gritti cases) was 10.7 inches, measured from the ischial tuberosity, the shortest being 8 inches. There were no operative complications in this group. However three reamputations of the femur have been performed which cannot be considered surgically complete, since two of these were complicated by soft-tissue breakdown and one by prolonged drainage. The incidence of complications in reamputations was 7.7 percent.

Thigh amputations may be divided into two groups, depending on the level of amputation; the first is that level at which a prosthesis may be fitted with partial or complete end weight bearing, the second, that at which a side weight-bearing prosthesis must be applied.

The sites of amputation that are considered as giving a satisfactory end-bearing stump are at a level of, or just above the distal articular



12. a. Patient admitted with open disarticulation of knee; patella remaining. b. Postoperative appearance after converting to a Stokes-Gritti amputation. Note position of scar posterior to weight-bearing area. Inadequate prepatellar skin would have necessitated an amputation at a higher level. c. Anteroposterior and lateral x-ray views after Stokes-Gritti amputation.

end of the femur. These levels extend from a disarticulation of the knee joint to the progressively higher levels of Slocum's condylar amputation, Callander's supracondylar amputation, Stokes-Gritti amputation, and finally, to that of Kirk's tendoplastic supracondylar amputation. All of these sites are based on performing the amputation at a level where the broad cancellous bone, with proper soft-tissue covering, will permit end weight bearing on the stump.

We prefer the Stokes-Gritti amputation, in that the slight natural convexity of the patella gives a better bone end for weight bearing (fig. 12). Many oppose this level of amputation because of the possible complication of nonunion of the patella to the distal end of the femur. Although our group of cases is small, we have not encountered this complication. Many limb-makers have opposed and still oppose these levels of amputation, as there is insufficient room for installation of the knee control in the end-bearing type of prosthesis.

Amputation stumps at a higher level in the femur above the broad cancellous bone end should not be fitted with an end-bearing prosthesis, as a painful bursa will develop and the tubular bone will have a tendency to cut through the overlying soft tissues.

The site of election for thigh amputations is considered to be at the junction of the lower and middle thirds of the femur. We have considered it more satisfactory to determine this site by measuring $4\frac{1}{2}$ inches from the interarticular space of the knee, with the leg extended, as this level gives sufficient room for the fitting of a proper prosthesis. In the patient of average height, three-fourths to an inch of stump length is saved, thus giving better functional stump control.

Reamputation has been performed in those cases in which the amputation was distal to this level, but above the level where end weight-bearing prosthesis could be given. These stumps may be fitted by dropping the knee joint of the prosthesis, but this gives a disproportionate thigh length to the prosthesis.

When it is necessary to amputate at a progressively higher level, increasing functional loss of the stump results, up to a level approximately $2\frac{1}{2}$ inches below the ischial tuberosity. At and above this level, the patient does not have sufficient length of stump to control the usual prosthesis. Every effort should therefore be made to preserve stump length. The proximal end of the femur in the short stump (trochanteric area) should not be removed, as it broadens the base of the stump and facilitates the use of the tilting-table prosthesis.

Leg amputations

Of the 137 completed below-knee amputations in 131 patients (6 bilateral cases), 67 stumps were considered satisfactory.

In 25 post-guillotine stumps, it was necessary to perform a revision for the excision of scar tissue and to secure closure with normal skin; 2 of these cases were complicated by prolonged drainage, 2 by soft-tissue breakdown, and 1 by an infected breakdown of the soft tissue; 2 of these cases required a secondary revision. Nineteen additional revisions were performed; of this number 2 were the result of operative complications, following revision performed at this hospital for resultant adherence of scar, and 1 for delayed separation of an operative scar after use of the prosthesis. The remaining 16 patients had had either a closed amputation or a revision performed prior to admission to this activity. Of this number 12 revisions were performed for adherent scars, 2 for delayed separation of the scars following use of the prosthesis, 1 for fibular shortening, and 1 for beveling of the tibia. Ten additional revisions have been performed which cannot be considered surgically complete, as 4 cases were complicated by prolonged drainage, 3 by soft-tissue breakdown and 3 by infection. The incidence of complications in below-knee revisions was 34.6 percent.

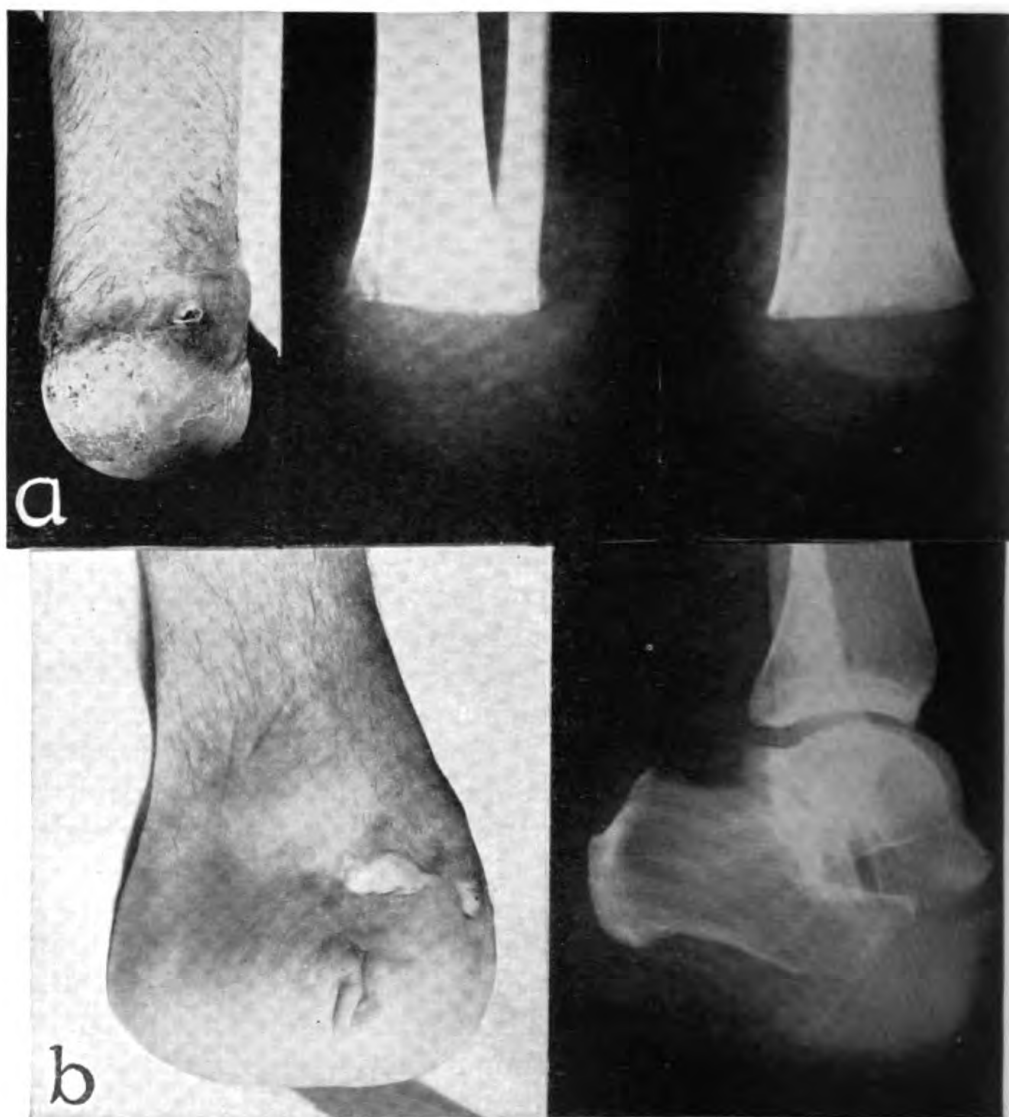
Four primary leg amputations were performed at this activity. In one case an open-flap amputation was performed for thrombo-angiitis obliterans and required no subsequent revision. Two patients had closed amputations at a site of election, one for extensive osteomyelitis of the tarsal bones with an associated 6-inch loss of tibia, and the other for amputation for circulatory disturbance, probably the result of too tight a cast for fracture fixation. This case required subsequent revision. There were no operative complications in this group.

Twenty-six reamputations were performed. Of these, 25 were operations at a site of election in cases in which the primary open amputation had been performed through the distal third of the tibia. Two cases were converted to Syme's level of amputation; in one the patient had been admitted with a Chopart's amputation with extensive loss of soft-tissue, and in one the ankle had been disarticulated. Fortunately intact heel flaps were present in both cases. One patient required an open-flap reamputation because of soft-tissue loss with bone protrusion. This case required a subsequent revision.

Five reamputation cases were complicated: 4 by prolonged drainage and 1 by delayed separation of the incision after use of a prosthesis. The latter case was the only one that required a revision. In addition to these cases, 3 other reamputations were performed, which, because of continuing drainage, cannot be considered surgically complete. The incidence of complications in reamputations was 32 percent. The average postoperative stump length in the 25 reamputations performed at a site of election was 6.2 inches.

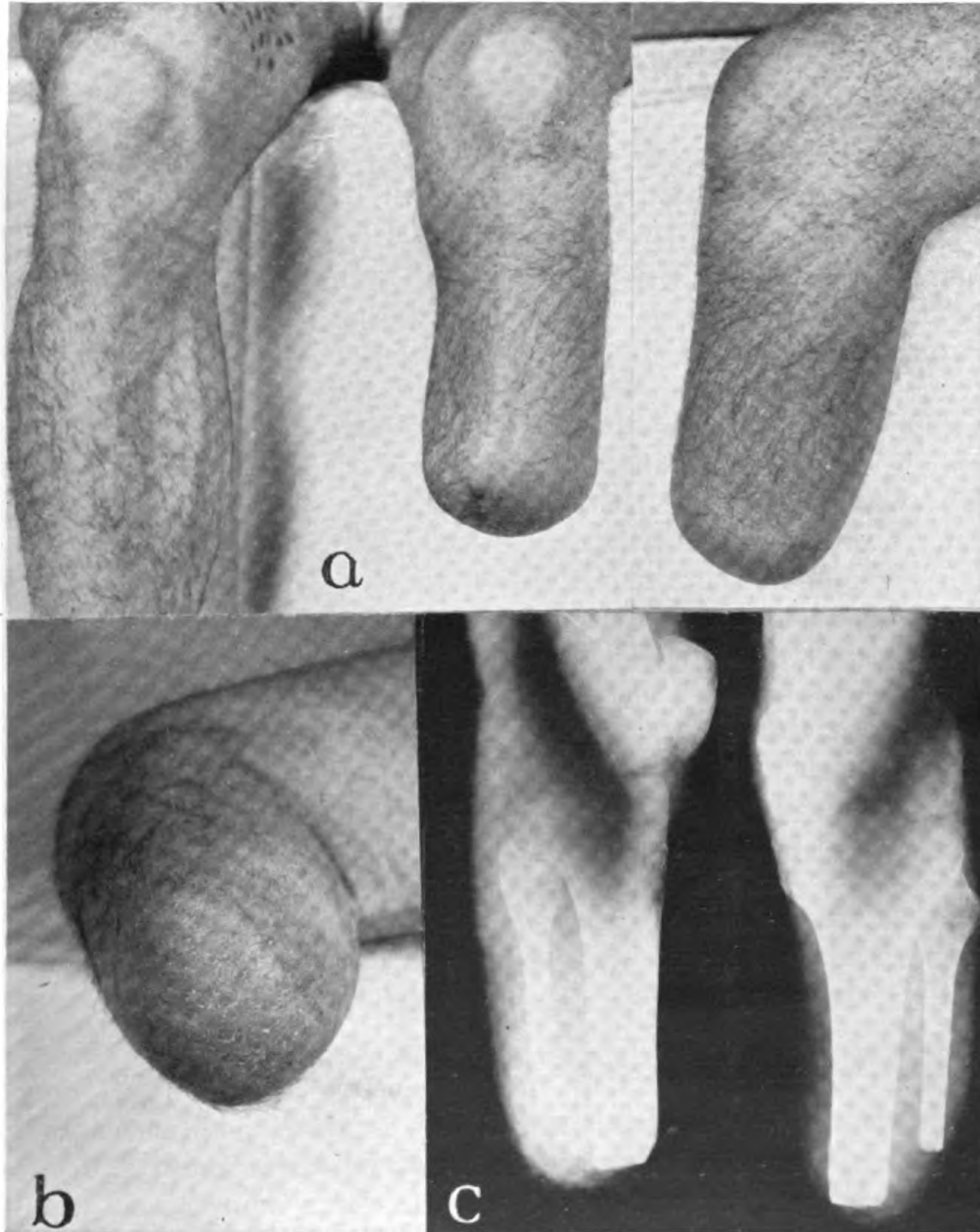
Amputations below the knee joint may be divided into two distinct levels: The first is that which will permit partial or complete end weight bearing on the stump, as Pirogoff's or Syme's amputation; the second is amputation performed at a higher level and must be fitted with a side weight-bearing type of prosthesis.

At this hospital we have preferred to employ only the Syme amputation in all cases that could be converted into end weight bearing stumps (fig. 13a). It is performed by dividing the tibia and fibula at the same level just at, or above the articular surface of the tibia. It is important to preserve the blood supply at this level of amputa-



13. a. Appearance of a Syme's amputation 4 weeks postoperatively. Note intact heel flap which is in neutral position. X-ray films show stump with tibia and fibula divided at the same level just above the articular surface of the tibia. b. Chopart's amputation. Note intact plantar aspect of stump.

tion, and very careful dissection is necessary in forming the heel flap. In postoperative care it is very important to maintain a neutral position of the heel flap, as any shifting of this flap will result in a poor stump. Adhesive strappings, extending well up the leg, usually give sufficient fixation, but in some cases it is necessary to introduce Kirschner wires through the heel pad into the distal end of the tibia to prevent displacement.



14. a. Amputation at site of election below knee. b. Note placement of scar posterior to bone end. c. Tibia beveled. Fibula divided at a higher level.

The higher site of election is at a point from 5 to 7 inches below the internal hamstring insertion, varying to some degree with the height of the individual (fig. 14). At this level the stump is of sufficient length to control the prosthesis and has adequate blood supply. Amputations at a lower level are prone to develop delayed trophic complications because of inadequate blood supply. Amputations at higher levels result in progressively less function until a point is reached $11\frac{1}{2}$ inch below the hamstring insertion, above which the stump has no functional value in the control of the prosthesis.

In some cases with a short below-knee stump it is necessary to lengthen the thigh corset or to add an ischial weight-bearing ring so that a large part of the weight bearing is transferred to a higher level. This relieves irritation from weight bearing and the stump is used only to activate the prosthesis.

Stumps that have a length of $11\frac{1}{2}$ inch or less from the internal hamstring insertion have no functional value. Two methods may be used in the management of this group of cases. The first is to reamputate the tibial stump at the level of insertion of the patellar tendon, permitting the tibial fragment to flex. A prosthesis is then fitted so that the weight is borne on the condyles of the femur, the patella and the short remaining tibial fragment. The second method is to reamputate above the knee joint; this method is preferable because a prosthesis is more readily fitted.

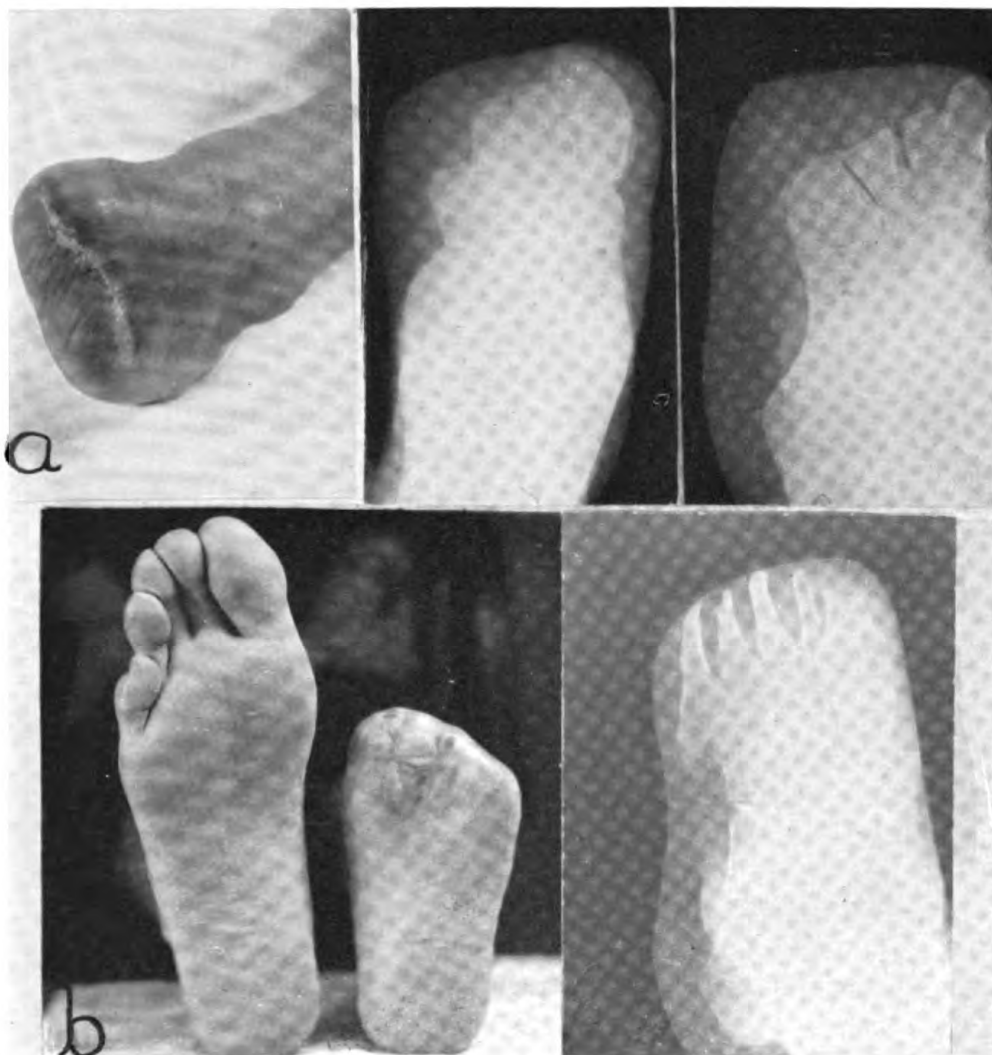
When amputations are performed at the sites of election, the fibula should be divided 1 inch higher than the tibia. In amputations at a higher level, the fibula should be divided just above the line of division of the tibia. Short stumps may require excision of the proximal end of the fibula, but we prefer leaving the fibula alone, except in those cases in which irritation with use of the prosthesis is caused.

We have not performed tibiofibular fusion and can make no comment on this procedure.

Patients admitted with closed amputations that had been performed below the site of election, who had a longer stump (9 or 10 inches below the hamstring insertion) did not receive reamputations unless circulatory complications developed from use of the prosthesis.

Partial foot amputations

Of 20 completed cases of partial foot amputations in 20 patients, 17 stumps were considered satisfactory. Of these 20 cases, 8 were transmetatarsal amputations; 3 were Lisfranc amputations and 4 Chopart amputations, and 5 patients had various combinations of partial loss of one or more metatarsal bones. Guillotine amputation had been performed in 6 cases, debridement with closure in 10 cases, and



15. **a.** Lisfranc amputation. Note scar above weight-bearing area and normal plantar skin flap. **b.** Transmetatarsal amputation. Extensive scar on plantar aspect necessitated a Lisfranc amputation. It is always important to save as much of the metatarsals as possible.

open-flap amputation in 4 cases. One revision was performed in a guillotine stump for excision of a terminal scar and removal of an exostosis. One patient had a full-thickness skin graft for replacement of an extensive terminal scar. One reamputation was performed, converting a transmetatarsal into a Lisfranc amputation because of recurrent breakdowns of a plantar scar. There were no operative complications in any of these cases (figs. 13b, 15a, 15b).

Every effort should be made to preserve maximum length of the foot. Amputations at progressively higher levels result in increasing muscle imbalance and the tendency to develop secondary contracture.

Scar location is of extreme importance in amputations involving the foot. The most desirable site is on the dorsum of the foot, but

if there are inadequate plantar flaps, terminal scars are acceptable. All extensive terminal scars should be revised if there is sufficient normal skin to secure closure without tension. If this is not possible, scar replacement by full-thickness pedicle skin grafts is indicated. Scar replacements on the plantar aspect of the foot are not satisfactory unless adequate protection from weight bearing can be afforded the patient for a long period of time.

Patients who develop contractures which cannot be relieved by conservative measures should have tenotomy and capsulotomy of the ankle joint. If contractures recur, arthrodesis should be performed, rather than conversion to a higher level of amputation.

When there is an extensive plantar scar with recurrent breakdown from weight bearing, amputation at a higher level is indicated. If the heel pad is intact, conversion to a Syme level of amputation is indicated, but if there is any loss of the heel pad, the amputation should be performed at the site of election below the knee.

Toe amputations

Of 11 completed cases of toe amputations, 9 patients were admitted with satisfactory stumps. In 6 cases there was complete loss of 1 toe, and 5 cases were multiple, with loss of 2 or more toes. Of the 11 cases, 9 had been primarily debrided and closed; 1 patient had had a guillotine amputation. One revision was performed for digital neuromas. One primary guillotine amputation was performed for gangrene due to circulatory interference from too tight a cast. There were no operative complications in this group.

Every effort should be made to preserve the maximum length of the great toe. A painful exostosis or digital neuroma should be

TABLE 1.—Revision, reamputation, and primary amputation

Site of amputation	No. of patients	No. of stumps	Post-guillotine amputation stumps			Post-flap-amputation stumps			Primary amputation performed here
			Total No.	No. of revisions	No. of reamputations	Total No.	No. of revisions	No. of reamputations	
Arm.....	89	89	48	36	11	41	10	3	1
Forearm.....	69	71	27	23	4	44	4	4	0
Partial-hand.....	14	14	3	0	0	11	3	0	0
Fingers.....	38	38	2	1	0	34	7	3	2
Thigh.....	177	183	93	58	35	94	15	1	2
Leg.....	131	137	51	25	26	82	20	0	4
Partial foot.....	20	20	6	2	0	14	0	1	0
Toes.....	11	11	1	0	0	9	1	0	1
Totals.....	549	563	231	145	76	329	60	12	10

¹ Guillotine amputation which required revision.

² 25 patients had 2 or more finger amputations at varying levels.

³ 6 required secondary revision.

⁴ 1 open-flap stump required revision.

⁵ 2 required secondary revision.

⁶ 1 open-flap stump required secondary revision.

⁷ 5 patients had 2 or more toes amputated at various levels.

excised, and no reamputation should be performed which would sacrifice bone length. A painful scar of the great toe should be replaced by a full-thickness skin graft.

The second toe should be saved when possible, as its presence lessens the tendency to a secondary hallux valgus. Painful contraction of the second toe can usually be corrected by an arthrodesis of its interphalangeal joints. If only a painful proximal phalanx remains, however, a disarticulation of the second metatarsophalangeal joint should be performed. If the remaining stumps of partial amputations of the third, fourth, or fifth toes are painful, these should be disarticulated through their respective metatarsophalangeal joints.

In table 1 have been summarized the statistics for the various operative procedures which were performed on amputation patients at this hospital. It will be seen that 549 amputees required 293 operative procedures. Obviously those who had an original guillotine amputation would require more secondary surgery than those who had some type of flap operation. How great this difference really is, is emphasized by our figures: Of the 231 post-guillotine cases, 221 (95.7 percent) required further surgery, as compared with 72 (21.3 percent) of the 329 post-flap-amputation cases.

TABLE 2.—*Complications in revision and reamputation*

Site of amputation	Post-guillotine stumps								Post-flap-open stumps							
	Revision				Reamputation				Revision				Reamputation			
	Total number	Soft-tissue breakdown	Infection	Prolonged drainage	Total number	Soft-tissue breakdown	Infection	Prolonged drainage	Total number	Soft-tissue breakdown	Infection	Prolonged drainage	Total number	Soft-tissue breakdown	Infection	Prolonged drainage
Arm.....	36	0	2	1	11	0	0	0	10	0	0	0	3	0	0	0
Forearm.....	23	2	0	0	4	0	0	0	4	0	0	0	4	0	0	0
Partial hand.....	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
Fingers.....	1	0	0	0	0	0	0	0	7	0	0	0	3	0	0	0
Thigh.....	58	2	0	4	35	0	0	0	15	0	1	0	1	0	0	0
Leg.....	25	2	1	2	26	1	0	4	20	0	0	0	0	0	0	0
Partial foot.....	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Toes.....	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Totals....	145	6	3	7	76	1	0	4	60	0	1	0	12	0	0	0

POSTOPERATIVE COMPLICATIONS

In table 2 have been summarized the complications occurring in revision and reamputation in patients whose treatment has been considered surgically completed. In addition, 16 revisions and 6 reamputations have been performed which cannot be considered surgically complete, because of complications.

Of the 60 revisions of the post-guillotine stumps of the upper ex-

tremity (5 of which presented complications) none required further surgery. The over-all incidence of complications was 8.3 percent. In contradistinction, 24 revisions of the post-flap amputation stumps of the upper extremity were performed with no complications. Twenty-five reamputations were performed on both post-guillotine and post-flap-amputation stumps with no complications.

There were 103 revisions performed on post-guillotine stumps of the lower extremity (16 cases cannot be considered surgically complete) with complications in 27 stumps, or an over-all incidence of 26.1 percent. Considering the total of 42 reamputations of the post-guillotine stumps of the lower extremity (6 of which are surgically incomplete), 7 complications occurred, or an over-all incidence of 16.6 percent. Two reamputations were performed on post-flap-amputation stumps with no complications.

The greater number of complications occurring in operative procedures on the post-guillotine stumps in comparison with the post-flap stumps is to be expected. The two factors chiefly responsible were poor blood supply and extensive scar tissue and wound closure with tension, particularly pertinent to the lower extremity.

SUMMARY

Of the 549 completed cases among the amputees admitted to this hospital, 197 required 205 revisions, and 88 others called for reamputation. Revisions were operations on the soft tissues to secure closure with normal skin, plastic procedures to eliminate soft-tissue defects, and the removal of painful neuromas. Reamputations involved bone removal.

We have presented our experiences with these operations. They are cited in groups according to the final level of amputation, and under each group are discussed the principles and technic of amputation and reconstruction applicable at that level.

Operation proved necessary in 95 percent of those who had had a guillotine type of original amputation, as contrasted with 21 percent of those who had had some type of flap amputation. Post-operative complications also were more frequent in the guillotine stumps than in flap-operation stumps, and more frequent in lower extremities than in the upper.

Operations for revision or reamputation were performed whenever possible only on healed stumps, because operations on unhealed stumps, both in our hands and elsewhere, were frequently followed by complications, the result of infection and poor blood supply.

In the management of these cases, major emphasis must be placed on closure with normal skin and on maintaining maximal length of the amputation stump.

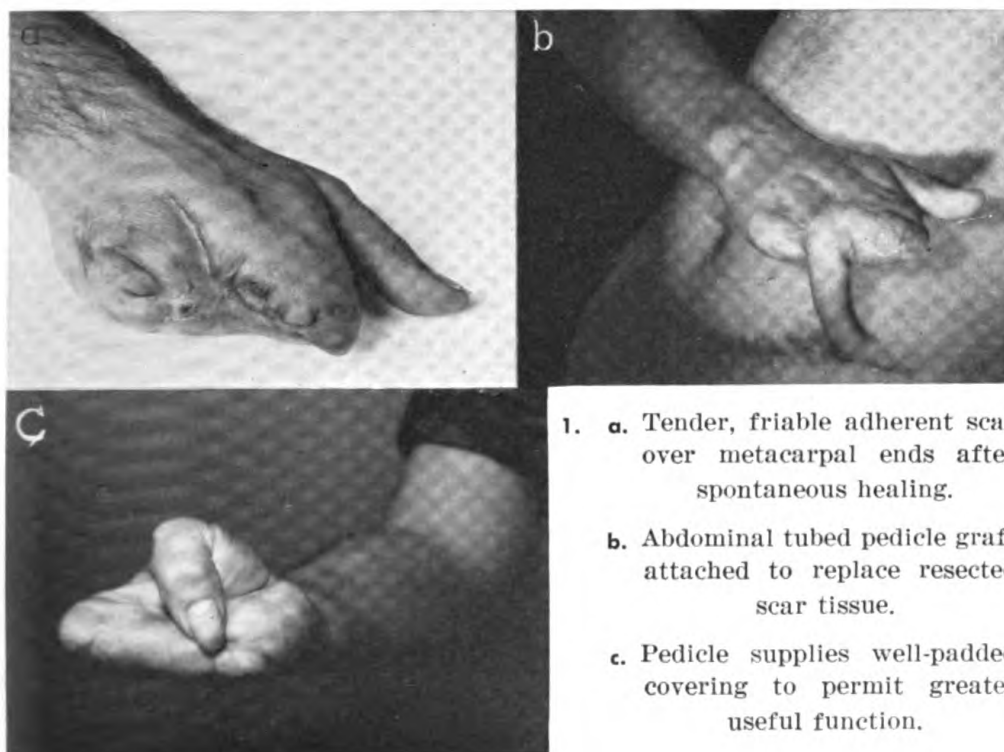
V. PLASTIC AND RECONSTRUCTIVE SURGERY OF AMPUTATION STUMPS

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On the amputation service of this hospital it has been the practice to submit selected patients for consultation and treatment by the plastic service. These include cases for the replacement of contracted scar tissue by skin grafts, the lengthening of short, useless amputation stumps, and the covering of large granulation defects and associated scar deformities of the face or extremities. The small routine skin grafts, to convert open infected stumps into healed wounds preparatory to revision, were performed successfully by members of the amputation service. Only the occasional infected open stump, which failed to respond to several attempts at grafting and prolonged treatment, was considered for radical excision and a pedicle graft. A series of cases with illustrations is presented for a consideration of these reconstructive problems.



1. a. Tender, friable adherent scar over metacarpal ends after spontaneous healing.
- b. Abdominal tubed pedicle graft attached to replace resected scar tissue.
- c. Pedicle supplies well-padded covering to permit greater useful function.

CASE REPORTS

PARTIAL FINGER AND HAND AMPUTATIONS

Case 1.—As the result of an exploding shell, the fingers of the right hand were lost, and healing by scar tissue was complete in 3 months. The adherent scar over the metacarpal ends was tender and easily traumatized; therefore replacement was planned by the transferal of a tubed abdominal pedicle. Elimination of the sensitive scar and replacement with normal skin, padded with subcutaneous fat, has provided a durable covering which should withstand the trauma of manual labor when sensation has returned. Despite the definite functional advantage of extending metacarpal ends by a tubed pedicle and bone graft for better thumb apposition, this patient refused this procedure because he planned to do heavy farm labor (fig. 1).

Case 2.—In this case loss of all fingers, including most of the second and third metacarpals, resulted from a shell fragment wound sustained over a year before final healing occurred. A similar method of reconstruction was planned, but in this instance the tubed pedicle was extended over the end of the intact



2. a. Healing wound after loss of all fingers and most of second and third metacarpals.

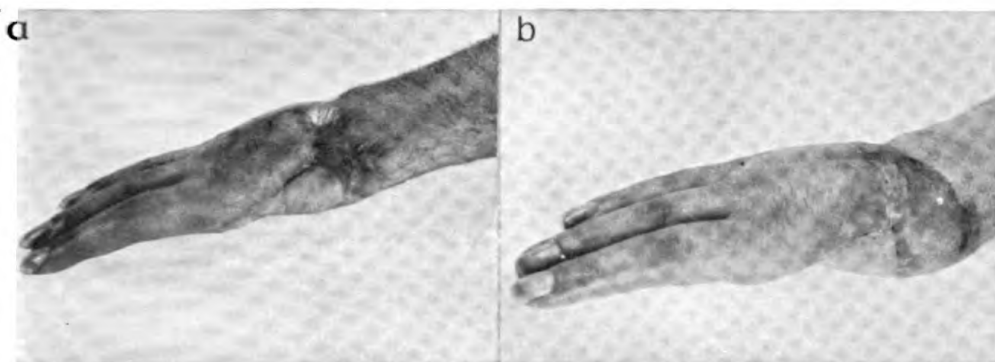


b. Tubed pedicle graft replaces scar on fourth metacarpal. Short bone graft will be inserted for improved thumb apposition.

fourth metacarpal. A short bone graft will be inserted into the tube extension in a position of about 45-degree flexion for improved thumb apposition.

Bone graft extensions, when placed as rigid extensions of fixed metacarpals, preferably should be short. The tubed pedicle covering must be protected from burns and trauma during the 6- to 12-month period of anesthesia, and the eventual return of sensation never is equal to the tactile discrimination of the normal finger. The importance of providing the increased functional advantage of apposition to the thumb should be considered (fig. 2).

Case 3.—Complete loss of the thumb and index finger in this case resulted from a rifle bullet wound, and the draining area was healed in 7 months. In this instance a reconstruction of the thumb was deemed inadvisable because



3. a. Loss of entire thumb and index finger with mass of friable scar.

b. Replacement of scar by pedicle graft to supply well-padded covering.

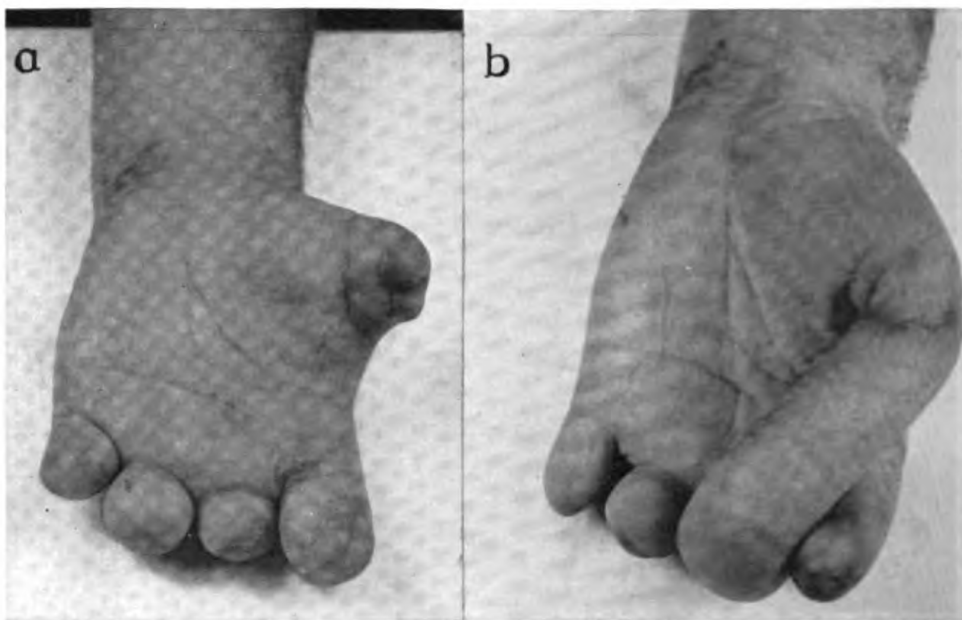
of complete absence of the first metacarpal and loss of thenar muscle movement. The adherent friable mass of scar was replaced by an abdominal pedicle and now permits the use of an artificial prosthetic thumb (fig. 3).

Case 4.—Following the explosion of a hand grenade, this patient had suffered partial loss of all fingers and the thumb. The amputation stumps were closed and healed within a month after the patient was wounded; reconstruction of the thumb and third fingers is proceeding with abdominal tubed pedicle. A definite increase in function is anticipated because the bone grafts can be attached to the proximal portion of several phalanges which remain. The source of the bone grafts can be the crest of the ilium, employed as a delayed graft as recommended by Commander D. T. Jones, or the twelfth rib as suggested by Commander Paul W. Greeley. This unfinished case is included to illustrate the plan and procedure for reconstruction of the thumb and fingers to provide increased hand function (fig. 4).

ARM AMPUTATION STUMPS

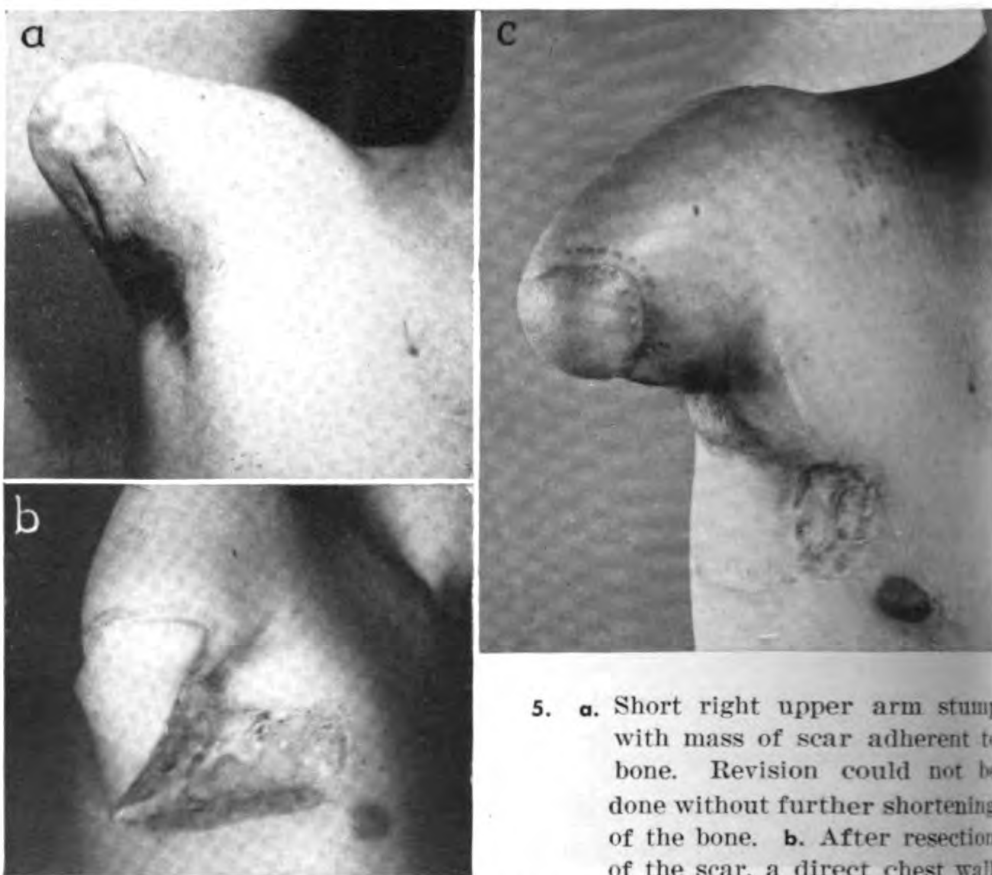
The following cases may illustrate equally well similar procedures on the short forearm stump to preserve or increase its length.

Case 5.—This patient required a guillotine amputation of the right arm following the explosion of a mortar shell. The wound was healed in 5 months,



4. **a.** Partial loss of all fingers and thumb resulting from grenade explosion. Stumps too short to permit function.

b. Abdominal tubed pedicle graft attached between thumb and third finger stumps. Bone grafts to be inserted later.



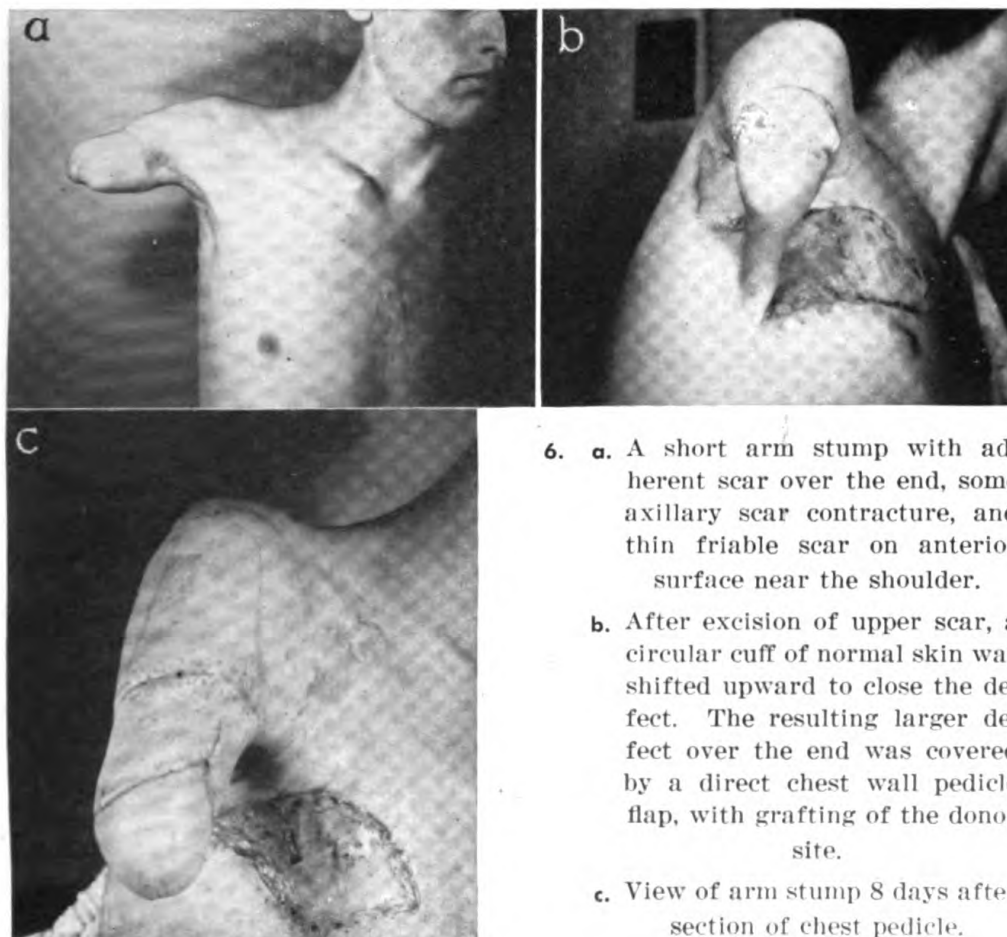
5. **a.** Short right upper arm stump with mass of scar adherent to bone. Revision could not be done without further shortening of the bone. **b.** After resection of the scar, a direct chest wall

pedicle graft applied. The donor site was grafted at the same time. **c.** Pedicle covering in position with replacement of remainder on chest wall.

with a dense scar-tissue mass covering the short stump of the humerus. The usual procedure of revision to eliminate the adherent scar could not be performed without further shortening of the humerus. In order to preserve the length needed to activate a prosthesis, the entire mass of scar was resected and an immediate, open, chest wall pedicle graft of skin and fat was applied to cover the stump defect.

In outlining a pedicle, it is important to plan some increase in width to allow for the normal retraction of the tissues when released from the tight, contracted scar. Immediate free grafting or closure of the donor site on the chest wall has proved advantageous and is done routinely in all pedicle grafts (fig. 5).

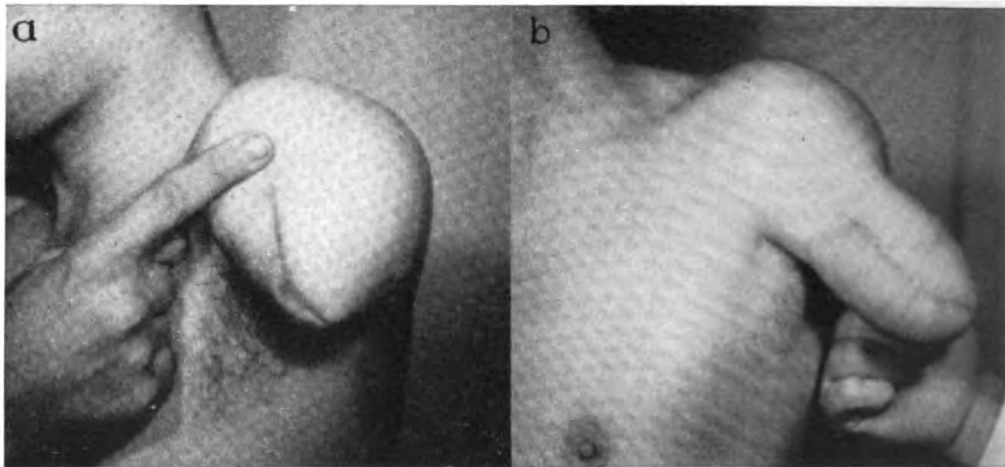
Case 6.—In this instance the right arm was lost as a result of a shell explosion and spontaneous healing was complete about 6 months later. A mass of contracted scar covered the short humeral end, but an axillary scar prevented abduction, and an area of friable scar was present on the anterior aspect. The latter had ulcerated repeatedly with the slightest irritation. A preliminary Z-plastic procedure released the axillary contracture. At a second operation, the anterior scar was resected and the circular cuff of normal skin and fat below was shifted upward to close this defect. The resulting larger defect, after resection of the adherent scar on the end, was covered at the same time by a direct chest wall pedicle. As the shoulder muscles are stretched



6. a. A short arm stump with adherent scar over the end, some axillary scar contracture, and thin friable scar on anterior surface near the shoulder.
- b. After excision of upper scar, a circular cuff of normal skin was shifted upward to close the defect. The resulting larger defect over the end was covered by a direct chest wall pedicle flap, with grafting of the donor site.
- c. View of arm stump 8 days after section of chest pedicle.

and loosened, it is felt that this well-covered stump will be in better condition to tolerate an arm prosthesis (fig. 6).

Case 7.—This very short upper arm stump which resulted from a shell explosion was partially closed and consequently healed with less scar in a period of a few weeks. An active trial was made with a carefully fitted prosthesis, but despite the intact attachments of the pectoralis, deltoid, and latissimus dorsi muscles on this 3-inch bony stump, it was too short to activate the artificial arm effectively. In our effort to individualize each case, a plan was evolved to lengthen the stump by utilizing the redundant skin and soft tissue on the dependent posterior portion to form a tube of skin and subcutaneous



7. a. A very short left upper arm stump showing patient's finger on end of the humerus and redundant soft tissue below.

b. Tubed pedicle graft constructed from redundant soft tissue of stump. A bone graft from the fibula will increase the length by 4 inches and permit activation of a prosthesis.

tissue. This was accomplished in one stage and at a second procedure a tibial bone graft from the fibula will be inserted into the humeral end. We consider this method shorter and a more direct approach, when applicable, to lengthen a very short stump, with every hope for increased function (fig. 7).

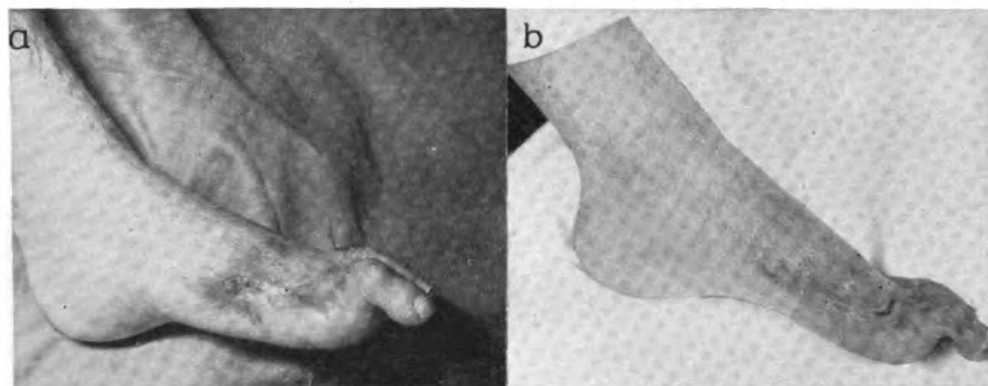
PARTIAL FOOT AMPUTATIONS

Case 8.—Loss of the left great toe, the distal portion of the first metatarsal, and the right lower leg resulted from a grenade explosion. Healing was prolonged for several months because of bone infection, and the adherent tender scar caused pain in walking. An adjacent pedicle flap on the dorsum of the foot was "delayed" at one procedure (i.e., partial preliminary elevation of the flap and re-suture in its original bed), and 2 weeks later this flap was rotated to cover the exposed bone after resection of the scar. The donor site on the dorsum of the foot was covered with a thick-split skin graft removed from the thigh. The choice of this method of repair was necessitated because a right leg amputation precluded the use of a cross-leg pedicle flap.

This method should be elected more frequently because it is usually less time-consuming and definitely easier for the patient. Since the

early depression of the split graft on the donor site fills in as the graft thickens rapidly and the rotated pedicle carries its normal sensation, the functional results should equal or surpass those of pedicles transferred from distant sites (fig. 8).

Case 9.—A mortar shell explosion caused the loss of the anterior portion of this patient's left foot. For 14 months the exposed infected bone resisted healing by intensive chemotherapy, repeated free grafts, and all forms of local treat-



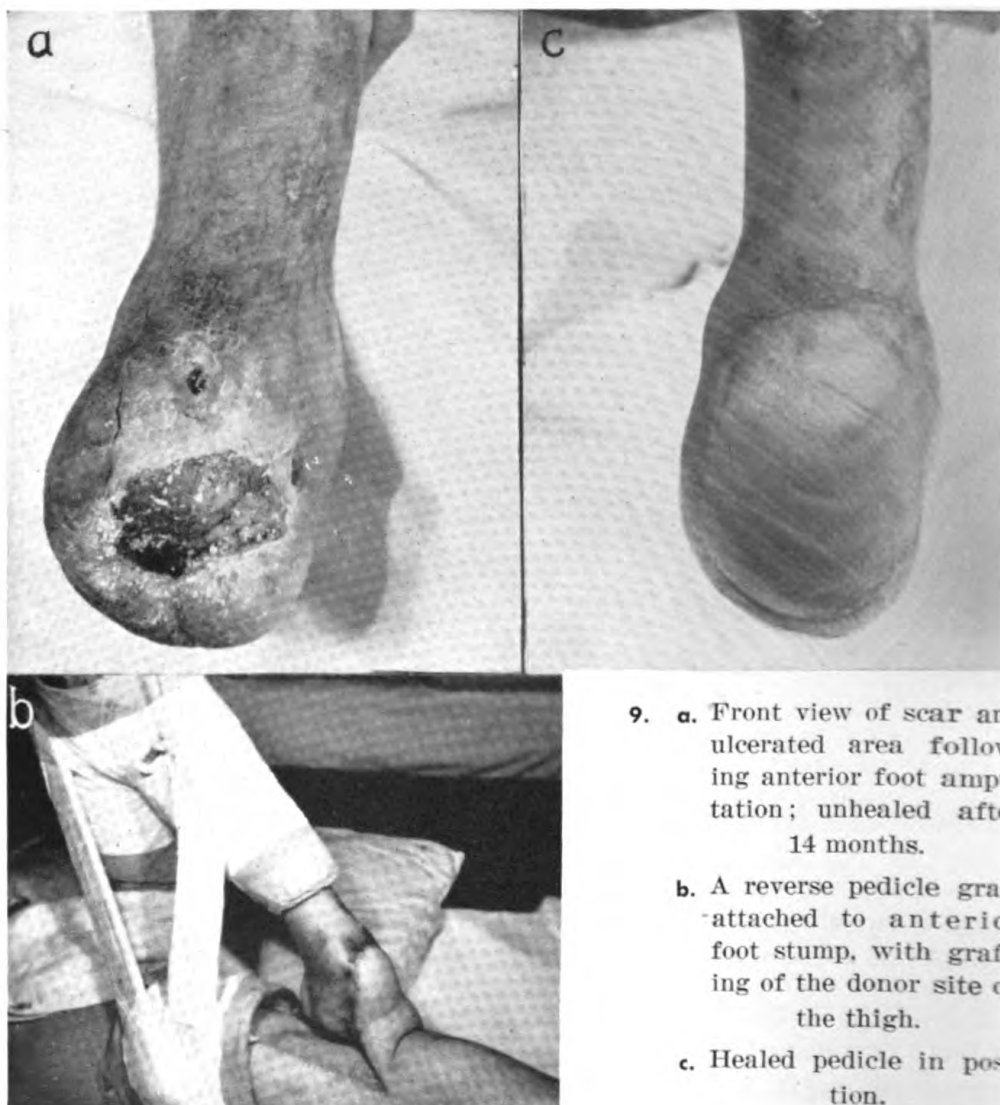
8. a. Adherent scar resulting from loss of great toe and distal portion of first metacarpal.

b. Early postoperative result from shifting the skin on the dorsum of the foot medially to cover the scar defect.

ment. When the reverse thigh pedicle graft was transferred, only a small clean granulation area remained in the center of a dense mass of adherent scar.

This type of reverse pedicle is applicable especially to anterior foot defects because of the direct, untwisted position of the flap. If this anesthetic graft can be protected until sensation returns, the probability of satisfactory permanent covering is considered good. This patient now has an undisturbed plantar heel pad of normal length for walking. In those cases, however, in which the pedicle graft must extend onto the plantar walking surface of the stump, there is grave doubt whether the lower border of the pedicle will tolerate the maximum trauma of weight bearing as the stump rolls forward with each step (fig. 9).

Case 10.—The amputation of all toes in this patient followed a grenade explosion. The loss of tissue over the exposed metatarsal ends required 10 months to heal and there was a tender adherent scar. Elimination of this scar was followed by immediate coverage with a delayed reverse calf pedicle from the opposite leg. Again the advantages of a pedicle application without angulation are apparent, and the lower donor site on the medial aspect of the calf provides a slightly more comfortable cast position. Inasmuch as all pedicles remain anesthetic for 6 months or longer, the patient must be warned to protect these areas. The improved functional result should justify the replacement of the scar tissue (fig. 10).

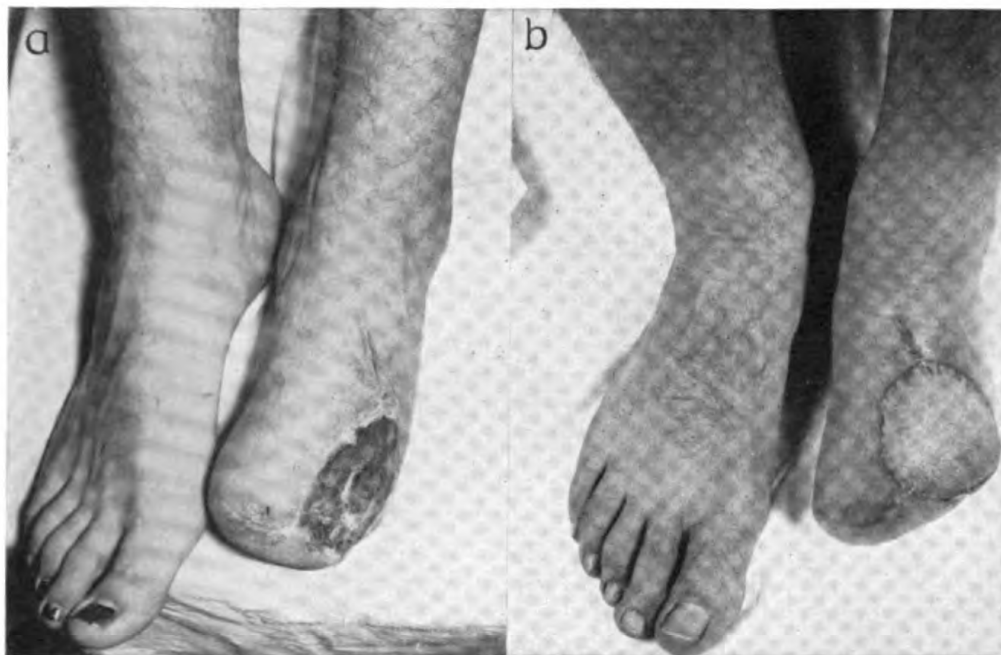


9. a. Front view of scar and ulcerated area following anterior foot amputation; unhealed after 14 months.
- b. A reverse pedicle graft attached to anterior foot stump, with grafting of the donor site on the thigh.
- c. Healed pedicle in position.

BELOW-KNEE AMPUTATION STUMPS

Case 11.—In this case the lower leg was lost in a crash-truck accident and there was avulsion of most of the skin below the knee. A clean granulation surface permitted the successful application of a thick split-skin graft over the upper portion and a thinner graft to cover the exposed tibial end. Now the anterior thicker graft is pliable and nonadherent and this will be left as a permanent covering, replacing only the adherent contracted portion with a reverse cross-leg thigh pedicle. Good knee action is present, and it appears that this below-knee stump may be preserved eventually for a good functional result (fig. 11).

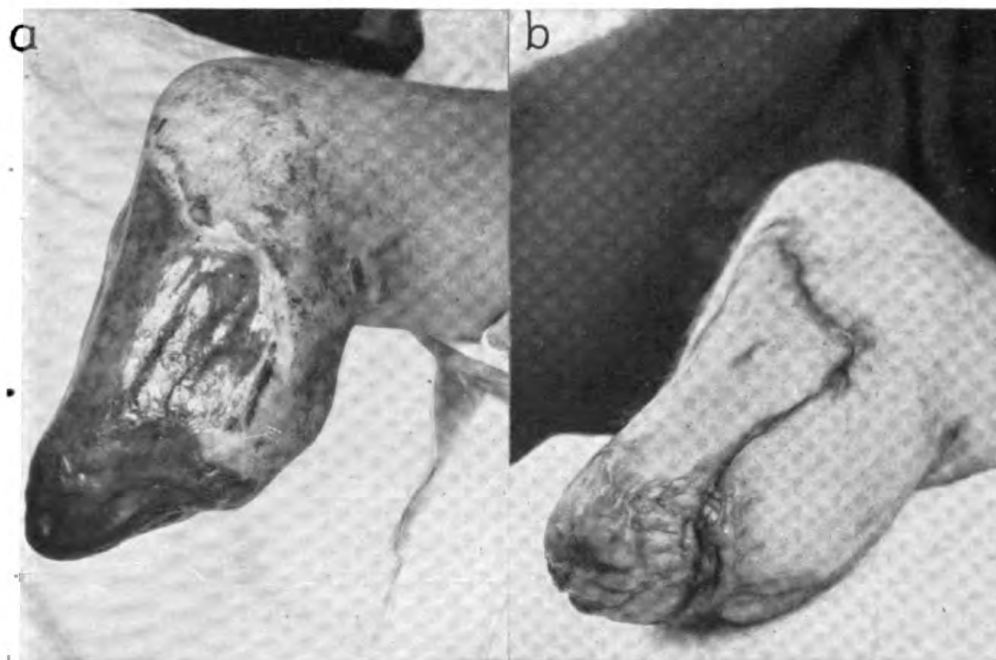
Case 12.—In a similar type of truck accident, the left lower leg of this patient was badly mangled. The appearance of the short below-knee stump shows the extensive scar and the badly infected ulcerated area in the center. For 2 years, repeated efforts to heal this area with free skin grafts and one calf pedicle had failed. A variety of organisms including streptococci and *Pseudomonas aeruginosa* could be cultured, despite the most intensive treatment with sulfonamide therapy.



10. a. Skin loss following amputation of all toes after a grenade explosion.

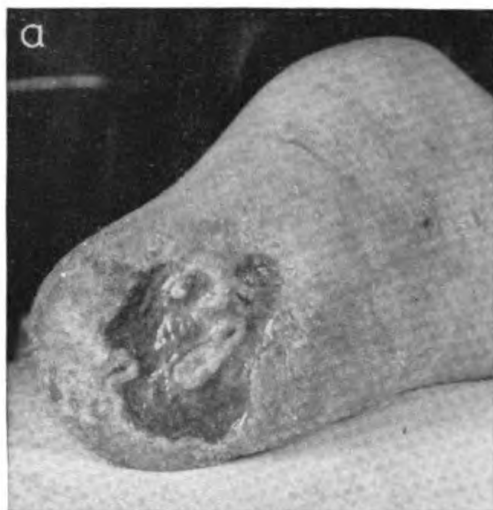
b. Replacement of healed scar by reverse calf pedicle graft from the opposite leg.

long courses of penicillin systemically and locally, zinc peroxide dressings, and streptomycin. Since this patient was adamant in his desire to save his below-knee stump, a wide excision of the ulcerated area was done, with immediate



11. a. Granulation area on short lower leg amputation stump after avulsion of skin.

b. Healed stump after split skin grafts. Lower portion attached to bone to be replaced by a pedicle graft.



12. a. A short lower leg stump with a severely ulcerated area surrounded by a wide mass of scar tissue.



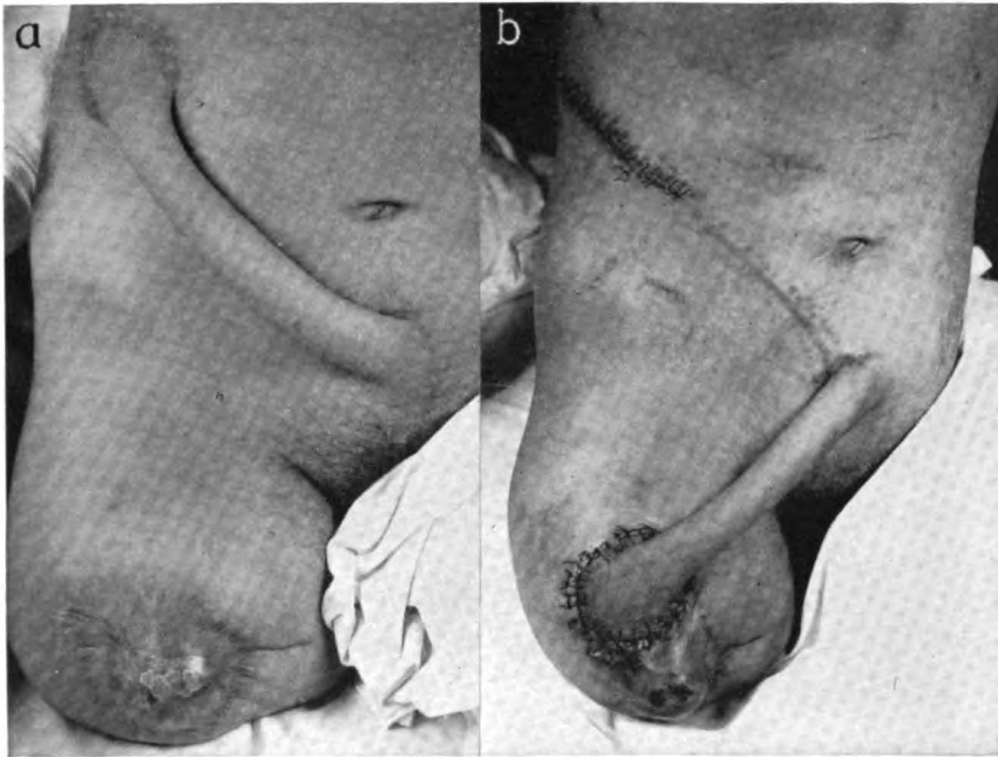
b. Early postoperative view showing successful application of two pedicle grafts to eliminate the ulcer and surrounding scar.

application of a reverse thigh pedicle. Despite intensive sulfonamide and penicillin therapy, severe infection with marked cellulitis and swelling occurred in the stump. There was loss of the distal inch of the pedicle as it was drawn too taut by the swollen tissues. Again this smaller remaining ulcerated area at the site of slough resisted all attempts to heal by free grafts.

Two months later a second adjacent reverse pedicle was raised on the thigh to cover the defect after excision of the granulation area and the remaining scar tissue near the knee. This was successful, although severe cellulitis and swelling caused a separation of all suture lines. His present condition shows both pedicles intact, with the narrow area of separation about the second pedicle healing rapidly. This case was included to illustrate the persistence of ulcerated areas on a base of dense scar where there probably is reduced local tissue resistance and immunity. Complete healing now appears assured; as sensation returns in the pedicle covering, it is hoped that this reconstruction may prove permanent, but in any event a higher closed amputation now can be done with safety (fig. 12).

THIGH STUMPS

Case 13.—A below-knee amputation on the left and a high thigh stump on the right were necessitated by a mortar shell explosion. Healing of the thigh stump by scar was complete in 4 months, but a routine revision could be accomplished only by a further resection of this short femoral stump. In order to preserve the present length for activation of a prosthesis, an abdominal tubed pedicle was constructed to cover eventually the exposed bony end, after elimination of the friable scar. This method was selected in preference to a cross-leg thigh pedicle because it is important to avoid further scar on the opposite leg where a prosthesis also must be worn. Likewise, the single linear scar from closure of the abdominal tube donor site is preferable in this instance to a skin graft, because a heavy supporting belt must be worn with the prosthesis.



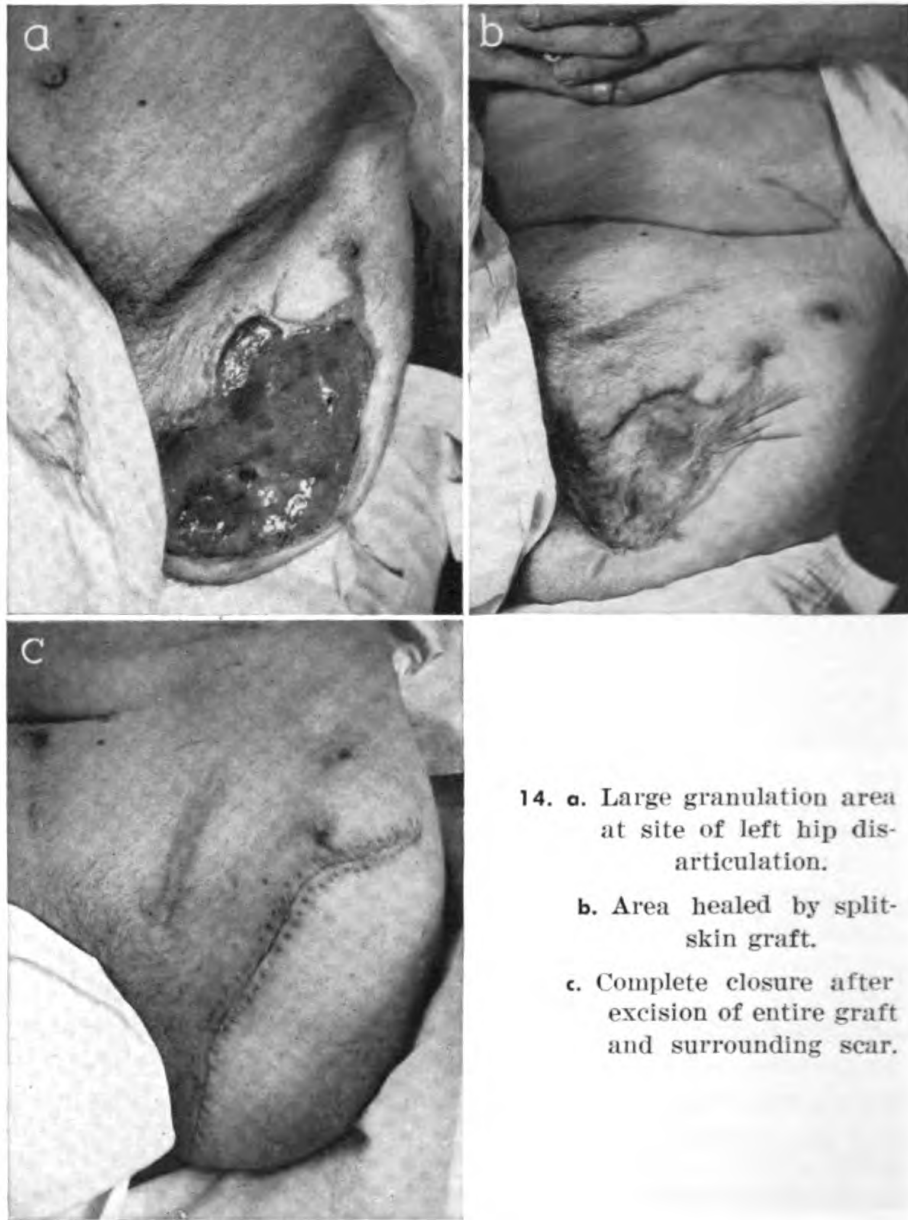
13. **a.** A short right thigh stump with a wide mass of adherent scar over the end of the femur. A tubed abdominal pedicle has been constructed.

b. Early attachment of tubed pedicle to stump for replacement of scar.

This incompleated case is shown to illustrate the plan of repair and the importance of individual planning for each case. Thoughtful selection of the best method of reconstruction is to be preferred to routine procedures (fig. 13).

Case 14.—Wounds from an exploding shell necessitated amputation of the right leg below the knee and a left hip disarticulation. The condition 2 months later showed a large granulation wound of the left hip which was healed by a split-skin graft in one stage. Three months later, after this patient's general condition had improved, it was possible to resect the entire adherent graft and surrounding scar, and achieve an immediate closure by wide undermining.

This case illustrates the importance of converting open granulation areas into closed, healed wounds by free grafts, with a resulting improvement in the general health of the patient. Likewise, when possible, an elimination of adherent scar or thin graft by undermining and closure is to be preferred to any form of graft. In this case, adequate padded covering has been provided to cover the sensitive areas of the disarticulation; the irritation from a prosthesis should be minimal (fig. 14c).



14. a. Large granulation area at site of left hip disarticulation.
- b. Area healed by split-skin graft.
- c. Complete closure after excision of entire graft and surrounding scar.

SUMMARY

The greatest single problem in reconstructive surgery of the amputation stump is the elimination of dense contracted scar tissue and its replacement by normal skin covering. Every effort has been made to plan the necessary pedicle grafts so that no further scars should be made on areas which could be irritated by the prosthesis. It is our opinion that attempts to preserve or lengthen short arm stumps by pedicle grafts are justified and provide the best opportunity for maintaining and increasing function.

Pedicle reconstruction of short lower extremity stumps we recognize as controversial. It is possible to secure a satisfactory application of

pedicle grafts even on infected surfaces, and the circulation remains good in the dependent position. The success of the graft will depend upon the elimination of undue pressure and irritation from the prosthesis during the period until protective sensation returns.

As large pedicle reconstructions on the weight-bearing surface of the foot have been permanently successful, it is reasonable to hope that, with the intelligent cooperation of the amputee, certain short lower extremity stumps likewise may be preserved for permanent useful function. We have cited 14 cases, with illustrations, to exemplify these principles and procedures.

VI. THE ROLE OF ASSOCIATED INJURIES AND COMPLICATIONS IN AMPUTEES

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Those who through trauma suffer the loss of a limb are at the same time commonly the victims of additional injuries. The nature and severity of such associated injuries vary widely with the circumstances under which the primary injury is incurred. Those whose amputations result from battle wounds are especially likely to present serious concomitant lesions as well as complications in the stump. These facts are of great importance, since they are often responsible for prolonged hospitalization, modification and conservation in the treatment of the stump and of the associated injuries, and difficulty in the fitting and use of prostheses.

A review of 769 amputees seen in the Philadelphia Naval Hospital shows that 757 of these patients required amputations as a result of traumatic injuries. Of the 757 patients, 406 (53.6 percent) suffered associated traumatic injuries. Eighty-one percent of these 406 patients sustained their associated traumatic injuries while in actual combat on land or at sea. The majority of patients had only a single associated injury while a few of them had multiple lesions, bringing the total number of associated injuries to 553 (table 1).

COMPOUND FRACTURES

Fractures presented a frequent and a complex problem. Of 553 associated traumatic injuries, 149 (37 percent) were fractures. Ninety of these were compound and 59 were simple fractures. Of the 90 compound fractures, 54 were sustained in land combat and 15 in sea combat. Compound fractures sustained in combat usually had

TABLE 1.—*Amputees with associated traumatic injuries*

	Patients with traumatic amputations	Patients with traumatic amputation complicated by associated injuries
Land combat.....	343	239 (69.7%)
Sea combat.....	146	90 (61.6%)
Duty accidents.....	188	61 (35.6%)
Liberty accidents.....	80	16 (20%)
Totals.....	757	406 (53.6%)

associated extensive loss of, or damage to, soft tissue and bone. The wound of exit of the missile commonly was the site of the most extensive soft-tissue damage. The bone substance was either carried away completely or badly comminuted. Infection, of course, was a common complication. In 23 of the compound fractures, osteomyelitis developed (table 2).

TABLE 2.—149 fractures associated with traumatic amputations

	Simple fractures	Compound fractures	Compound fractures with osteomyelitis
Land combat.....	14	41	13
Sea combat.....	19	11	4
Duty accidents.....	21	12	6
Liberty accidents.....	5	3	0
Totals.....	59	67	23

Treatment

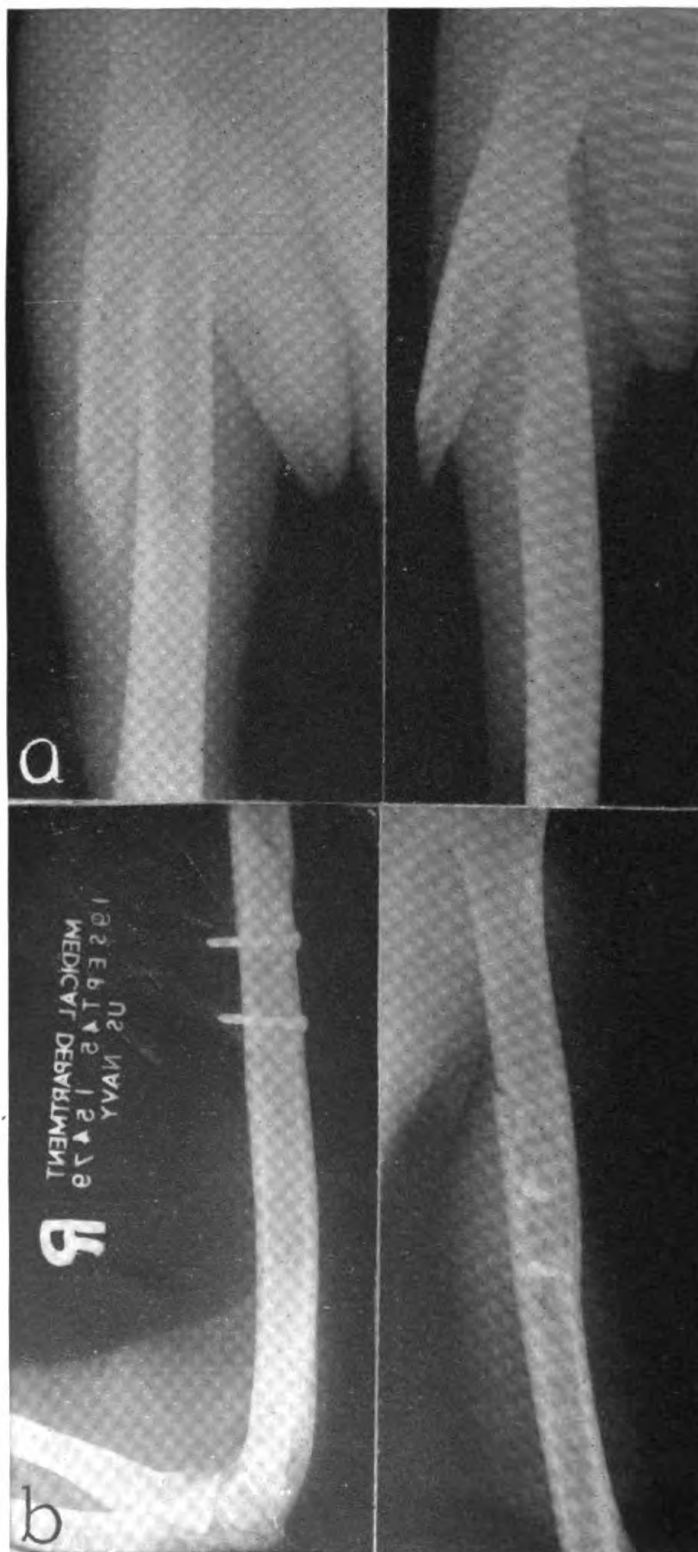
Adequate reduction, alinement, and fixation are the first requisites of healing of any fracture. Failures to secure good results are usually not due to the type of procedure employed, but rather to the inexperience of the surgeon in using the various methods of fixation. A pin above and a pin below the fracture and the application of a cast, with or without a window for subsequent dressings, does not entail any serious hazard. Where maintenance of alinement is not difficult, a simple circular cast may be applied. Good results are obtained by this conservative method of treatment.

As a result of experience in a base hospital in the South Pacific, it is my opinion that extensive primary debridement in compound fractures should not be attempted in the battle zone, but rather that the wound should be cleansed and accessible foreign material removed with as little soft tissue loss as possible. Readily applied fixation should then be instituted. Later, at a base hospital where adequate equipment and personnel are available, further surgery and a more or less permanent fixation may be applied. In cases in which the wounds were closed and casts applied in the forward areas, gas gangrene and loss of a limb sometimes resulted and in a few instances loss of life.

Before any method of internal fixation of compound fractures is attempted, the wound must be healed or closed. The skin at the site of fracture must be free of scar tissue and have a good blood supply. This can be accomplished by secondary closure of a wound, removal of scar tissue, and tissue replacement by either split or full-thickness skin grafts. Internal fixation need not necessarily be by metal plate or bone graft. In one of the patients, not an amputee, the size and

position of fragments were such that reduction and fixation were achieved by simple transfixion with metal screws (fig. 1).

In delayed union, or nonunion, after conservative methods had

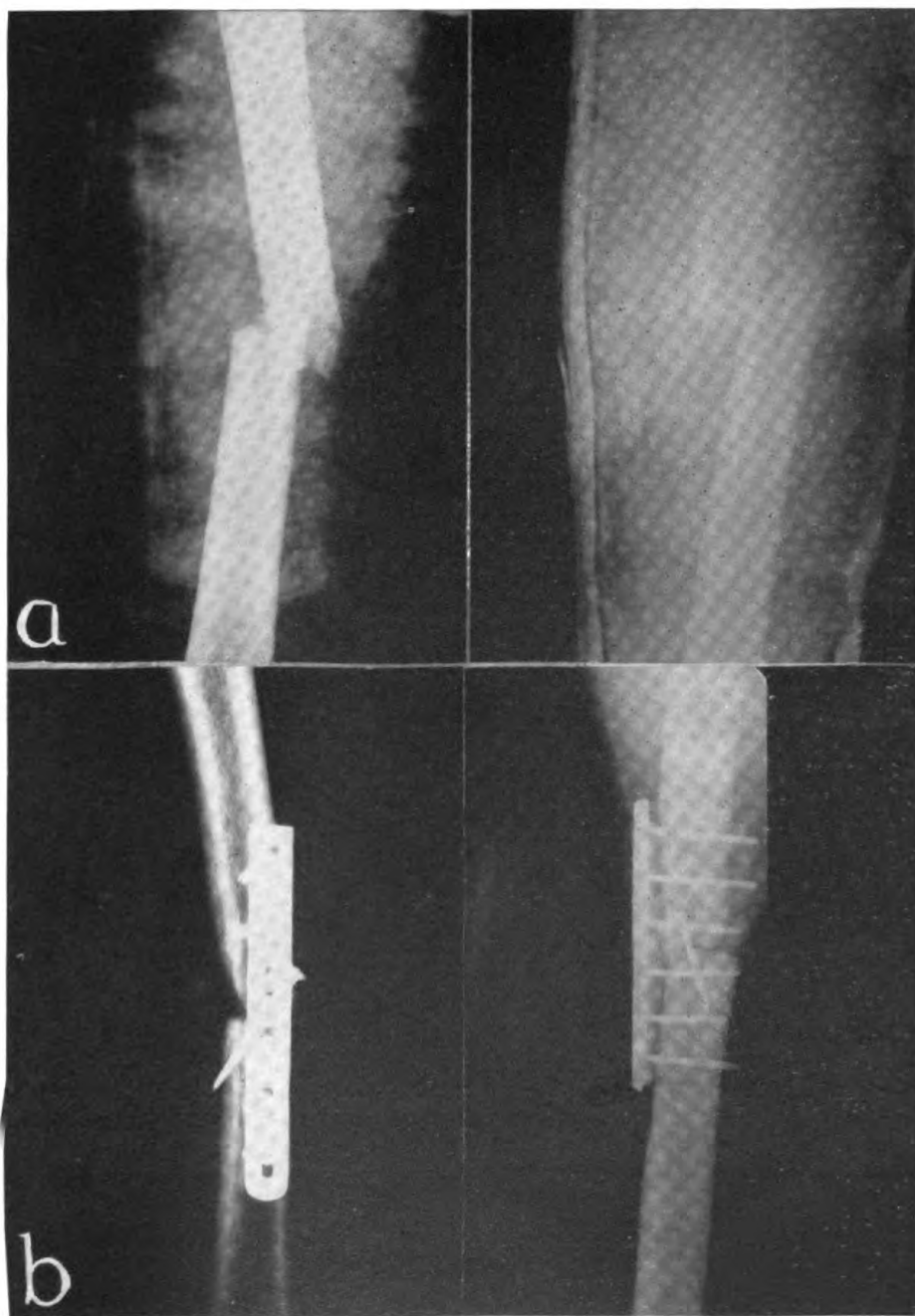


1. Simple oblique fracture of the humerus.

a. Before operation: Lateral and antero-posterior.

b. After operation: Lateral and antero-posterior.

failed, some operative procedure had to be employed to secure healing of the fracture. In cases in which the opposite extremity was lost, a loss of length within reasonable limits, that is, $1\frac{1}{2}$ or 2 inches, was justifiable to remove sclerotic bone and secure apposition. Fixation by a metal plate or bone graft, or both, usually proved successful. In a number of cases the two-stage on-lay bone graft was



2. Simple transverse fracture of the right femur. Bone graft with Townsend and Gilfillan plate and screw. **a.** Before operation: Anteroposterior and lateral views. **b.** After operation: Anteroposterior and lateral views.

utilized. This graft was lifted from the donor site, shaped, holes were drilled and the graft was then replaced in its original bed, and the wound closed. Three or four weeks later the fracture site was exposed and prepared and the graft was taken from its bed and applied to the fracture site.

The graft must have smooth coaptation and be secured by three screws above and three screws below the fracture line. The screws must penetrate the opposite cortex. It is necessary to have not only firm internal fixation, but also firm external fixation. The method of choice of the latter depends on the operator. Occasionally external fixation is not practicable for one reason or another and we must rely on internal fixation only, as illustrated in figure 2.

The most perplexing problems occurred in those compound fractures of a lower extremity with extensive loss of bone substance (fig. 3). Especially when the opposite extremity had been lost, we dared not take any chances that might result in irreparable damage, so first attempted to bridge the gap by bone-grafting. The graft,



3. Lateral and anteroposterior x-ray views showing loss of bone substance.

or grafts, may be taken from the ilium as for the double on-lay grafts. The ilium is accessible and the type of bone lends itself to grafting.

In figure 4 is shown the result of such replacement of a tibial defect by a graft from the ilium. The use of the fibula as a graft

4. Compound fracture of the tibia and fibula, right.

a. Before operation: Anteroposterior and lateral views.



b. After operation: Anteroposterior and lateral views.

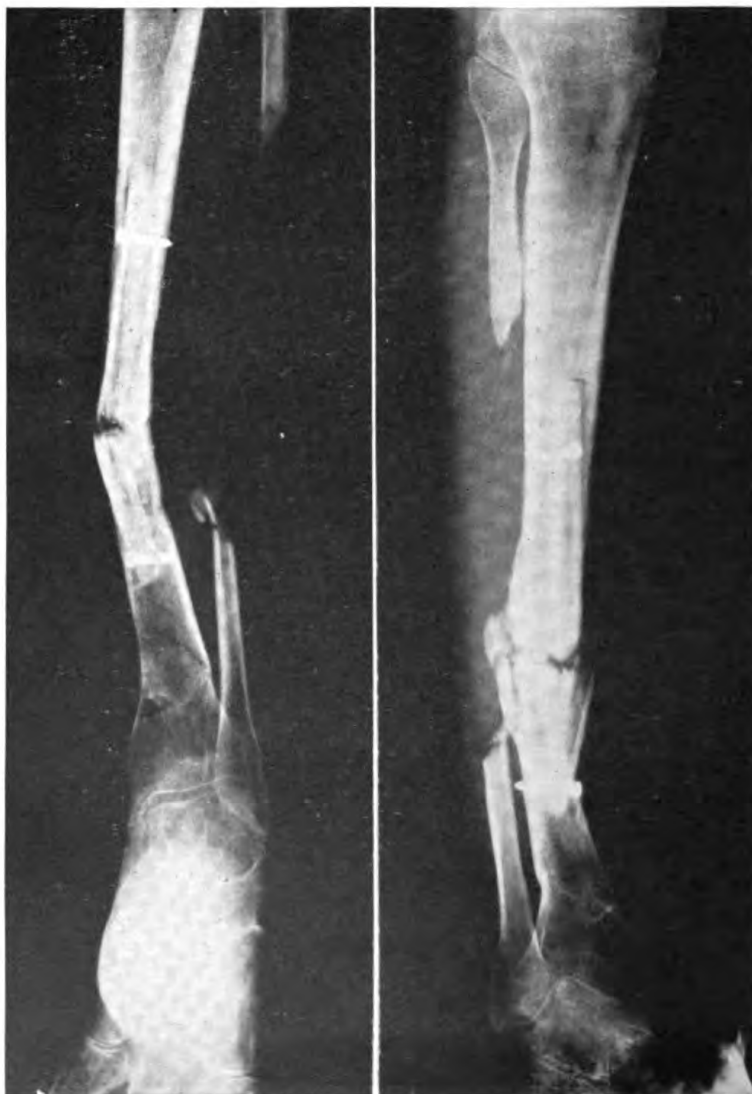


should be the last resort, and then it should be done only in several stages. If the fibula as a whole is used as a graft and is lost, one is faced by a critical situation. In figure 5 is shown an example of a fibula used as a graft (not an amputee patient), in which the graft was lost.

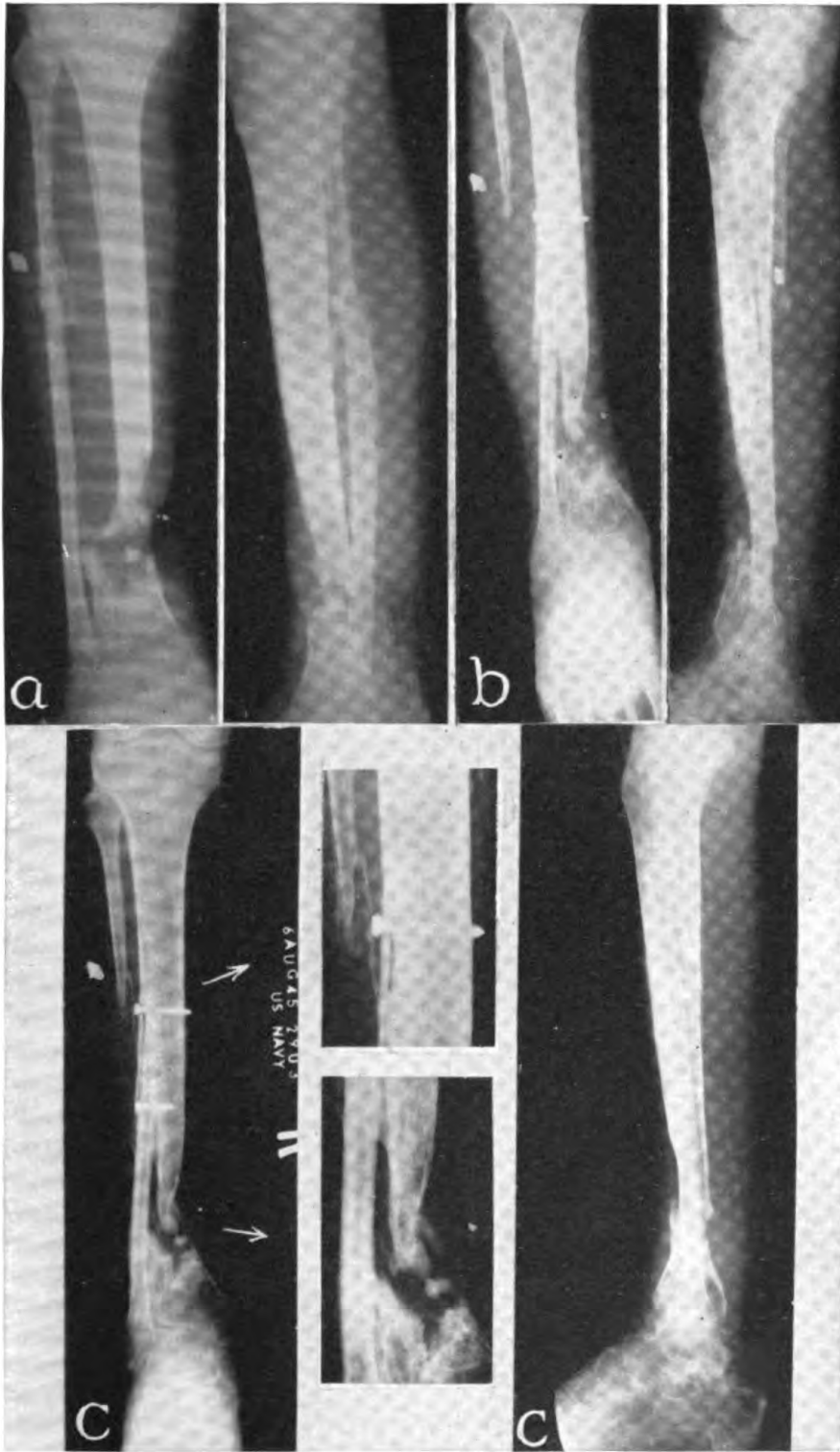
Fusion of the fibula to the fragments of the tibia should be carried out in two stages. The fibula is transected a suitable distance from its upper end, and the free end of the lower segment is grafted to the tibia. At a later date, an arthrodesis of the lower tibiofibular joint is performed, plus a fusion of the bone shafts for some distance above this joint. This procedure, carried out in one of our non-amputee patients, is demonstrated in figure 6.

Massive sliding tibial graft, as described by Gill,¹ is a very good

¹ GILL, A. B.: Treatment of ununited fractures of bones of forearm. Surg. Clin. North America 12: 1535-1544, December 1932.



5. Compound fracture of the right tibia. There was loss of the fibula following transplant.



6. Compound fracture of the tibia and fibula. **a.** Before operation: Anteroposterior and lateral views. **b.** After first operation: Anteroposterior and lateral views. **c.** Three months after second operation. Note growth of periosteum.

procedure when the tibial fragments are not comminuted or too short as a result of loss of bone substance.

In two patients, each with a fracture of the femur, there was malunion with marked angulation at the site of the fracture. Not only was there very obvious deformity, with considerable shortening, but



7. Simple fracture of the left femur. **a.** Before operation: Anteroposterior and lateral views. **b.** After operation: Anteroposterior and lateral views.

there was impaired locomotion. In each instance a two-stage osteotomy, as developed by Moore,² was performed on the femur with a very satisfactory result (fig. 7). A wedge-shaped piece of bone is removed at the site of the angulation, the base of the wedge including the outer aspect of the deformed shaft, the apex of the wedge reaching nearly to the inner side of the shaft. The wedge is cut into small chips which are put into the newly made defect. The continuity of the bone is thus preserved by a thin bridge of bone on the inner aspect of the angular deformity. The wound is closed and a spica cast, including the pelvis and entire leg, is applied. Three or four weeks later the cast is removed and the deformity corrected by manipulation. Another cast is applied. With this procedure, there is little danger of the fragments slipping because of nonunion.



8. Multiple fracture of pelvis.

Compound fractures complicated by osteomyelitis were treated by the generous use of penicillin. This consisted of the intramuscular injection of 120,000 to 200,000 units every 24 hours. As a means of controlling infection in the exposed soft tissue, dressings soaked in zinc peroxide were applied. Conservative surgery was stressed. Incision and adequate drainage of pus pockets were routinely performed. In removal of sequestra and in curettage, care was taken not to leave overhanging edges; in other words, saucerization was done with as little loss of healthy bone as possible.

² MOORE, J. R.: Personal communication.

SIMPLE FRACTURES

Treatment

Of the 149 fractures in our amputees, 49 were simple ones. The treatment of simple fracture in the amputee was no different than the treatment of simple fracture in any other patient. Again, adequate reduction, alinement, and fixation are necessary for good results. The methods employed depend on the individual surgeon and the success of each depends on his experience with it. A pin above and a pin below the fracture and the application of a cast constitute the simplest and safest method of providing fixation, particularly if early transportation of the patient to another area is desired. In all combat areas, transportability was a necessity (such as removal to an air-raid shelter).

There were, however, two instances in which complete reduction of simple fractures was impossible, each because of multiplicity of fractures involving more than one bone, and excessive damage to adjacent joints and their ligaments. One of these cases was that of a man with multiple fractures of the pelvis, involving the sacroiliac joint, the symphysis pubis, and the hip joint (fig. 8).

On 14 August 1944, when his ship was torpedoed, a 24-year-old sailor was thrown so violently against a bulkhead that his left leg passed through it. He sustained a fractured jaw, multiple fractures of the right half of the pelvis, and a dislocation of the left knee with extensive soft-tissue damage. On 26 September a high left thigh amputation was performed. The pelvic fractures were treated first by Russell traction applied to the right leg and later by manual manipulation and external fixation. Accurate anatomic alinement of the fractures was not achieved, nor could it have been with this type of injury. Today there is an increase in the lordotic curve, the patient walks on his prosthesis with a left-sided gluteal limp, and has considerable pain in the right pelvic region and groin and in the midlumbosacral area.

JOINT INJURIES AND COMPLICATIONS

Joint derangements were due to contractures, to penetrating wounds with and without infection, and to fractures into, or adjacent to, the joint. The contractures, numbering 84, were due to muscle imbalance, the stump being drawn toward the side of the stronger muscle. Moderate contractures were corrected by physiotherapy and exercise. The more severe ones were treated with wedge cast, traction and manipulation. Surgical intervention and a brace were employed in the extreme cases.

The most severe soft-tissue damage to a joint occurred in one patient who had a rupture of the anterior crucial and internal lateral ligaments, plus extensive articular damage due to fracture. Repair of the ligament was not considered advisable. A brace was applied and the lateral ligament has tightened up considerably, with sufficient



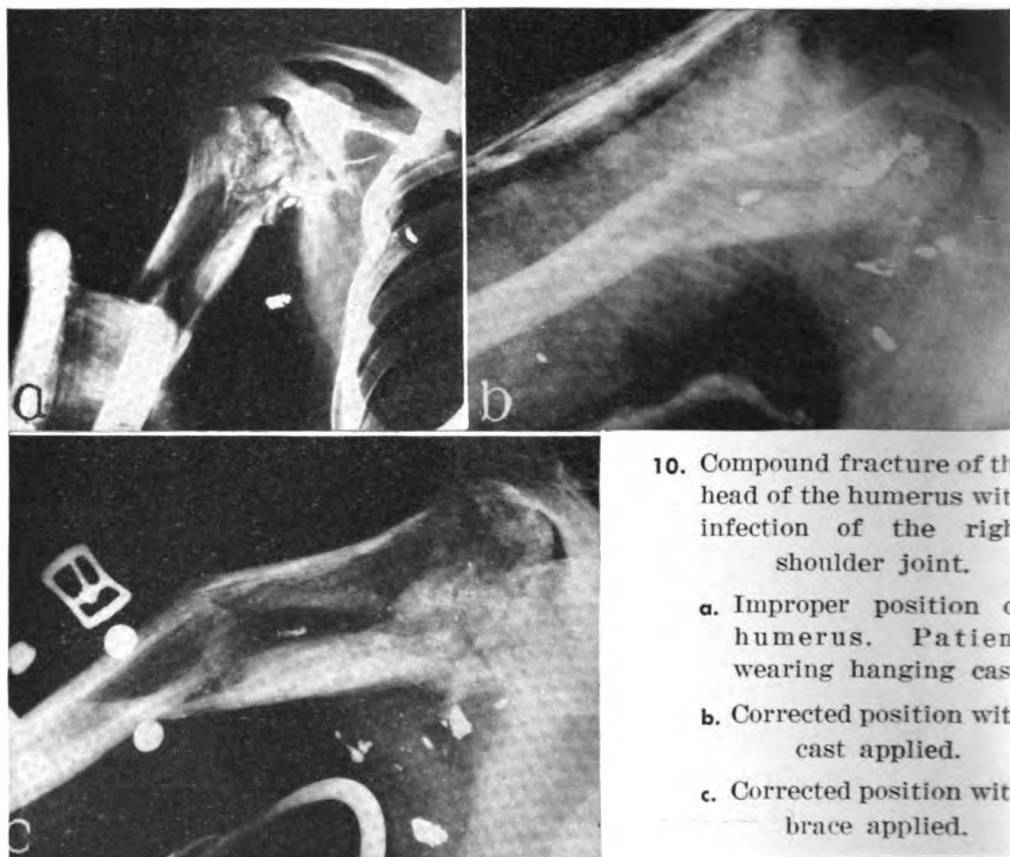
9. Compound fracture of the head of the humerus with infection of the shoulder joint. Fused in poor position.

function. There was only one case of fracture of the internal meniscus, the result of underwater explosion. An arthrotomy was performed and the damaged cartilage removed.

Extensive joint damage was due in 14 cases to penetrating wounds followed by infection and subsequent destruction of the articulating portions of the involved bones with complete loss of joint function. Figure 9 shows a compound comminuted fracture of the head of the humerus, with infection. Partial resection of the head of the humerus was performed at another activity. At this hospital a sequestrectomy was done with excision of infected soft tissue. Later, as soon as the infection has cleared up, a stabilization procedure will be carried out.

No surgical stabilizing procedure in a joint should be attempted in the presence of active infection, or through a granulating wound. The extremity should be fixed in the most favorable position in the hope that fusion will take place (fig. 10). Note the great destruction of the shoulder joint, with infection.

The humerus was maintained in abduction, almost to a right angle, by a cast with a window cut out over the shoulder joint so that the wound could be dressed. Later an abduction arm, so constructed as to permit flexion and extension of the elbow, was applied. This brace will be worn until the wound is healed. Fusion is taking place and, clinically, is fairly firm. This same procedure can be carried out in



10. Compound fracture of the head of the humerus with infection of the right shoulder joint.

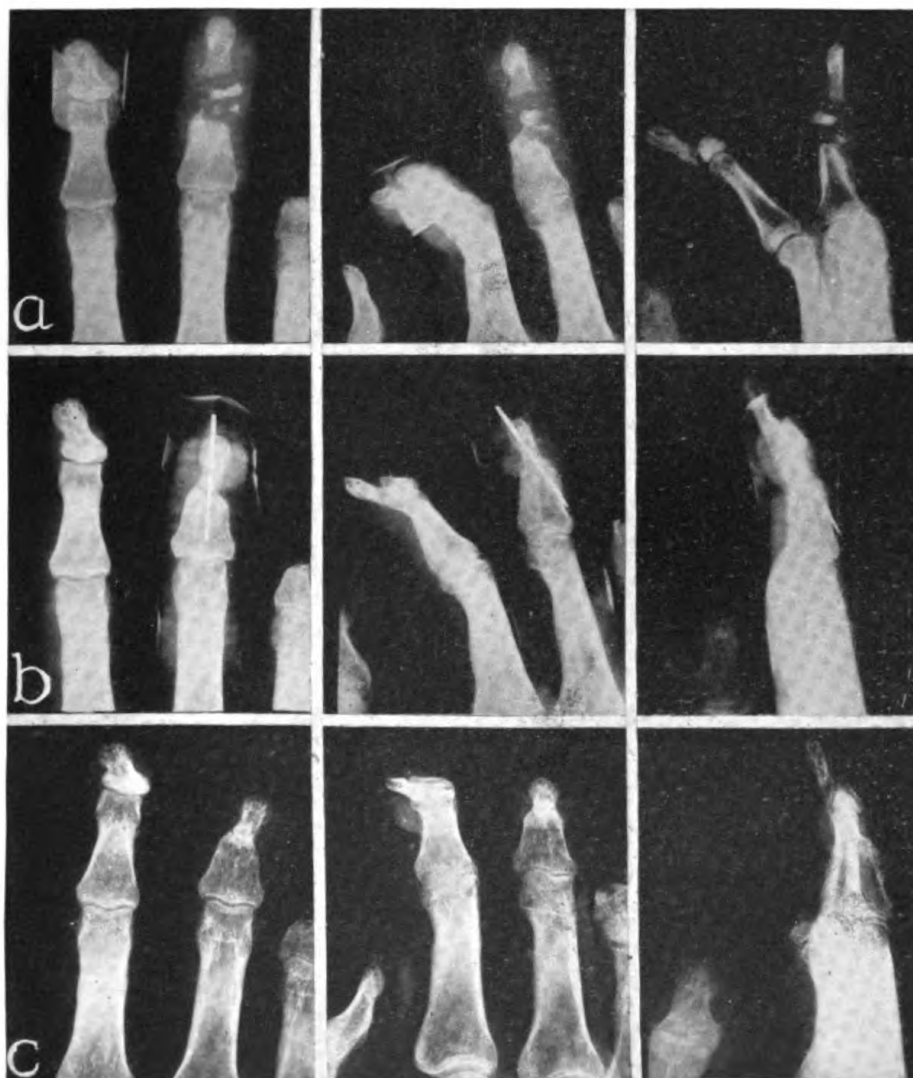
- a. Improper position of humerus. Patient wearing hanging cast.
- b. Corrected position with cast applied.
- c. Corrected position with brace applied.

the smaller joints as shown in figure 11, showing an arthrodesis of the distal interphalangeal joint of the index finger in moderate flexion.

Fractures in or near a joint in 13 patients caused marked joint damage with restricted function. A partly or wholly fixed, but non-painful joint was preferred to a freely movable but unstable joint. Surgical procedures varied with the joint involved. It was obvious that in injuries to the elbow joint, with resultant restriction of motion, restoration of flexion sufficient to enable a patient to get his hand to his mouth, to the top of his head, and to the back of his neck was more important than to be able to extend his forearm beyond a right angle.

In the case of a patient with a fracture of the elbow with restricted flexion due to bone impingement, sufficient flexion for all practical purposes was obtained by removal of the bony projection. A patient with bilateral below-knee amputations and bilateral tibial plateau fractures had marked restriction of flexion of both knees. With physiotherapy and manual manipulation, flexion of the knees was obtained to a right angle. This is all that was necessary for the fitting of his prostheses (fig. 12).

Surgical fusion of a joint (arthrodesis) may be desirable in the ankle, providing the opposite leg is intact. In only one of our cases



11. Compound fracture of index and middle fingers, right. **a.** Before operation. **b.** After operation. Pin inserted for fixation. **c.** Fusion.

was an arthrodesis deemed necessary, however. Figure 13 shows a compound fracture of the lower end of the tibia with extensive joint damage. Motion was very restricted and painful. Fusion in this case was obtained by the removal of the articular cartilage of the lower end of the tibia, superior surface of the astragalus, and both malleoli. A sliding tibial graft was then placed over the ankle joint and secured into the neck of the astragalus.

When there has been a loss of a leg on one side and a damaged ankle on the opposite side, arthrodesis of the ankle is not desirable. We have one such patient. Fusion of the subastragalar joint (astragalus and os calcis) may be done, for this joint has to do with only lateral motion of the foot and not ankle motion. This is a procedure frequently used in fractures of the os calcis or astragalus, with limited painful lateral motion of the foot.



12. Bilateral fracture of the tibial plateau. **a.** Anteroposterior views, left and right. **b.** Lateral views, left and right.

SOFT-TISSUE INJURIES

Shell fragment wounds

Of the 370 patients who had associated soft-tissue injuries, 249 sustained theirs as a result of shell fragment wounds; of these 186 occurred in land combat and 47 in sea combat (table 3).

Shell fragment wounds with draining sinuses always should be ex-



13. Compound fracture of the tibia and fibula. **a.** Anteroposterior and lateral roentgenographs before operation. **b.** Anteroposterior and lateral roentgenographs after operation.

plored. All of our patients with draining sinuses had, in addition to metal fragments, other foreign material such as clothing, dirt, stones, etc. in the sinus tract. Lipiodol, or a dye, will often facilitate the localization of the foreign substance. Shell fragments which did not cause any symptoms were not removed, except in a few instances in which the fragment was easily accessible, and to relieve the patient's mind. Occasionally superficial shell fragments became infected secondarily and had to be removed.

Lacerations

Fifty-nine of the patients had lacerated wounds of various degrees. These were treated in the usual manner. Whenever the condition of

TABLE 3.—*Soft tissue injuries (\$70) complicating traumatic amputations*

	Lacera- tions	Shell fragment	Nerve injuries	Burns	Visceral injuries
Land combat.....	21	186	17	3	7
Sea combat.....	16	47	6	15	1
Duty accidents.....	16	13	3	3	4
Liberty accidents.....	6	3	0	2	1
Totals.....	59	249	26	23	13

the laceration permitted, immediate wound suture was carried out. In cases in which there was extensive damage to soft tissue, the wound was left open and a secondary closure was done at a later time.

NERVE INJURIES

Twenty-five patients suffered associated nerve injuries, 22 (88 per cent) occurring in the combat group. It is interesting to note that the left extremities were involved twice as often as the right. Seven of the twenty-five patients had sciatic nerve injuries. In 1 patient, the sciatic nerve was severed completely with a 2-inch loss of nerve substance. The sciatic nerve was damaged at the lower thigh level in 2 cases and attempts to suture the nerve have been unsuccessful. In a case in which the sciatic nerve was partially severed, almost complete recovery has occurred. Five of the patients are wearing "foot drop" ankle braces with improvement of the foot drop.

There were five cases with wrist drop, two the result of shell fragment wounds, two the result of too tight a tourniquet applied to an extremity, and one the result of injury to the musculospiral nerve due to pressure from the edge of the operating table.

HEAD INJURIES

Thirty-eight patients with traumatic amputations suffered injuries about the head. The most serious were those involving the eyes, since these at times resulted in permanent damage. Three of the four patients with skull fractures and those who experienced ruptured ear drums recovered completely. Combat accounted for head injury in 33 of the 38 cases (table 4).

Eye injuries

Twenty amputees had associated eye injuries. The injury in 15 was unilateral, resulting in enucleation in 8 cases because of orbit perforations. The other 7 unilateral cases involved impaired vision that in 4 instances was improved by glasses. Of the 5 instances of bilateral eye injuries, an enucleation of one eye had to be done in 2

TABLE 4.—*Head injuries complicating traumatic amputations*

	Eyes				Perforated ear drum		Skull fracture	Total
	Unilateral		Bilateral		Uni-lateral	Bi-lateral		
	Loss	Injury	Loss	Injury				
Land combat.....	7	6	0	1	5	3	2	24
Sea combat.....	1	1	1	3	3	0	0	9
Duty accidents.....	0	0	0	0	2	0	2	4
Liberty accidents.....	0	0	0	0	1	0	0	1
Totals.....	8	7	1	4	11	3	4	38

patients, one of whom was also completely blind in the other eye, while the second had partial vision in the remaining eye. Two amputees on admission were completely blind in one eye, and in the other eye had vision so impaired as to be able to distinguish only large objects. One of these patients has experienced considerable improvement in vision in the one eye during his stay here. The fifth patient with bilateral ocular injury was temporarily blind but eventually recovered normal vision in both eyes.

Ear injuries

Fourteen patients suffered rupture of the drum head, all due to explosion, 12 in combat and 2 in accidental explosions of dynamite. In 3 the injury was bilateral, while in 11 only 1 ear was affected. In all cases the perforation has healed and hearing is within the normal range.

Skull injuries

Four amputees sustained fracture of the skull. Three were compound, requiring trephining and plating in two, one of whom had a residual hemiplegia. The other compound skull fracture involved only the outer table and healed without incident, as did the simple fracture. One patient, after an explosion, had a temporary paralysis of all four extremities and incontinence of the bladder and bowel. On x-ray examination there was no evidence of skull fracture, so that the clinical picture must have been due to concussion from blast effect. He made a complete recovery.

ASSOCIATED INJURIES

One of the most serious aspects of the baneful effects of associated injuries upon the progress and outlook of amputees lies in the relation of those injuries to the fitting and use of prostheses. Any in-

jury, by delaying the patient in getting and using his artificial limb, increases the risk of atrophy of muscle groups attached to the stump and of impairment in the function of the adjacent joint.

Of all associated injuries, fractures unquestionably present the most serious situations, and these are worst in case of lower-extremity amputees. If the fracture is in the leg, a portion of which has been amputated, there will obviously be delay in the use of the prosthesis. If, in addition, healing and alinement are imperfect, it may be difficult or impossible to fit a prosthesis.

The most serious situation obtains when the associated fracture involves the pelvis. All the previously mentioned difficulties are present. In addition, there is commonly present an upward displacement of the ilium on one side, which increases the lumbosacral angle with a shift of the body weight forward. This results in a marked so-called gluteal-muscle limp and pain in the lower back. The limp is usually not correctable. If an attempt were made to relieve the lumbosacral pain by means of a lumbosacral fusion, the pain would only tend to be shifted to a higher level. In short, little or nothing can be done for the gluteal limp and the lumbosacral strain.

SUMMARY

Associated injuries were a frequent complication in those who had suffered an amputation as a result of trauma. Of 757 such amputees, 406 (53.6 percent) had such associated injuries. The incidence of these, in turn, was higher among those patients who had lost a limb in combat (67.2 percent) than among those injured in accidents (28.7 percent).

Among the 757 amputees, the commonest associated injuries were those of soft tissues caused by shell fragments (249 cases). The commonest complication was contracture of the adjacent joint (84 cases). The most serious associated injuries and their complications were those presented by the 149 fractures, 90 of which were compound. Of the 25 nerve injuries, all but 3 occurred in combat.

Associated injuries in amputees, in general, delayed their progress, particularly in getting out of bed, with consequent atrophy of muscles, especially those attached to the stump, and with contractures and impairment of joint function. They commonly delayed and at times made difficult the fitting and use of a prosthesis. Fractures, especially those in a lower extremity of a leg amputee, caused all of these difficulties, and at times in addition gave rise to skeletal malposition and consequent functional disorders, notably limping and pain.

VII. REVIEW OF 59 PATIENTS WITH MULTIPLE AMPUTATIONS

WILLIAM L. WHITE

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Among the 769 amputees admitted to this hospital, 58 had amputations involving two extremities and one had suffered partial loss of three limbs. The problems encountered in the management of these patients with multiple amputations are chiefly concerned with loss of functional ability. In this group of cases, the range of incapacity extended from complete loss of extremity function in the triple amputee, who also had an ununited fracture of the femur in his only full-length extremity, to a relatively minor incapacity in a patient who had lost the index finger and a portion of the corresponding metacarpal on one hand and a part of the middle finger of the opposite hand.

While these 58 amputees probably constitute only from 30 to 40 percent of patients with multiple amputations in the Navy and Marine Corps, still an analysis seems justified. These cases are considered not only from the point of view of their incapacity, but also in terms of anatomic sites of amputation, the circumstances of injury, the traumatic agents, and the indications for amputation. With special reference to the double amputee, surgical considerations, prostheses, associated injuries, and mental attitudes are discussed briefly.

Anatomic classification

Although anatomic level cannot be used to determine final functional result, still it offers both a well defined method of classification and a crude index of function. We have, therefore, considered amputations at or above the wrist or ankle joints as major, and those distal to these joints as minor. On this basis, the patient with the three amputations was considered a triple-major amputee, because both arms had been removed at the axillae and the left leg 9½ inches below the knee. The remaining 58 double amputees are divided into 33 major-major; 22 major-minor; and 3 minor-minor. Because the extent of incapacity varies within each of these 3 groups, it is necessary to consider the various combinations within the 3 categories as presented in the accompanying table.

*Classification of 59 amputees with multiple amputations***TRIPLE AMPUTEE***Major-Major-Major*

Bilateral arm and below-knee.....	1
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DOUBLE AMPUTEES*Major-Major*

Bilateral below-knee	9
Thigh and below-knee.....	9
Bilateral thigh	8
Forearm and below-knee.....	2
Forearm and thigh.....	2
Bilateral forearm	2
Arm and thigh.....	1
Total	33

Major-Minor

Below-knee and toes.....	8
Below-knee and fingers.....	1
Thigh and toes.....	1
Thigh and fingers	2
Arm and fingers.....	1
Arm and toes.....	1
Below-knee and partial foot*.....	2
Thigh and partial foot*.....	1
Thigh and partial hand.....	1
Forearm and partial hand*.....	4
Total	22

Minor-Minor

Bilateral partial foot*.....	1
Partial hand and partial foot.....	1
Partial hand and fingers.....	1
Total	3

* Minor amputations of moderate functional disability.

The patient with amputation of three extremities, while still under surgical treatment and confined to bed, is completely dependent upon others for all of his activities, as without both arms and one leg he is completely helpless. His future accomplishments with prostheses remain to be determined. It is likely that when his femoral fracture has become firmly united, he will be able to walk with a fair degree of ease, as his below-knee amputation stump is of sufficient length

to permit good prosthetic function. At present his prospects of artificial arm control are not very favorable, inasmuch as both humeral stumps are exceedingly short.

In the table it is seen that 26 patients lost major portions of both lower extremities. Until they have been fitted with suitable prostheses, locomotion in these patients is limited to wheelchairs. With prostheses, however, all have been or will be able to walk with varying individual success. The 5 patients who had arm or forearm amputations in addition to below-knee or thigh amputations were also limited to wheelchair travel, except one of them, who was able to walk satisfactorily with crutches. With small-wheel rolling chairs, these patients are able to propel themselves by pushing with their good leg and rolling the chair backward. With practice they become quite proficient in this means of locomotion.

The two patients with bilateral forearm amputations, although able to walk with ease, were quite helpless until they obtained prostheses. By necessity these men have both become exceedingly adept with their hooks, using either of them with far greater skill than any other patient with only one forearm amputation. One of these patients has only recently obtained his prostheses, but shows great promise in their use. After a period of 3 months, the other patient was able to put on his prostheses, attend his toilet, dress, read a book or newspaper, feed himself with the customary utensils, use a typewriter, telephone, handle money, smoke, and perform many other daily functions and activities. His greatest obstacle is the button. While he is able both to button and unbutton clothing with considerable effort, he usually solicits aid in this daily act. A motion picture has been made of this man, representing a day's activity. This exceptional technicolor film is shown to new arrivals on the amputee wards, who gain confidence from the accomplishments of this bilateral forearm amputee.

In the group of 22 patients with major-minor amputations, the minor amputations in 15 are not sufficiently incapacitating to differentiate them strikingly from patients with single amputations. The minor amputations include associated toe and finger losses in these 15 amputees, all of whom are able to manage their daily activities independently. Those with 1 complete hand and part of another which has a grasping function are able to perform daily activities such as dressing and feeding themselves. Those with missing digits who have also lost part of a lower extremity manage crutch walking satisfactorily.

The remaining seven major-minor patients have slightly greater disabilities, though none of them is as incapacitated as those with two major amputations. Four of these seven major-minor amputees have

partial hand loss in addition to major forearm amputations. The minor amputation in one of them is through the thumb metacarpal; in another the second metacarpal and proximal thumb phalanx are sites of amputation, while the minor loss in the other two patients has reduced the hand to two fingers. The remaining three amputees with partial foot amputations, associated with a major loss of the opposite extremity, will at the completion of treatment easily be able to accomplish crutch walking.

There are only three patients in the group of minor-minor double amputees. One with bilateral Chopart amputations is at present completely unable to stand upright or walk, and therefore, functionally, he should be described as a major-major amputee. Another patient with a Chopart amputation and loss of one index finger through its metacarpal is only slightly incapacitated by his more minor amputation. The remaining patient was discharged without a prosthesis, with almost complete functional ability; he had lost a portion of a finger on one hand and had only a single finger amputation through the index metacarpal of the opposite hand.

Indications for amputation

Only 1 of the multiple amputations was done because of a non-traumatic disease. The patient had bilateral high thigh amputations for Buerger's disease. The remaining 58 were done as a direct or indirect result of trauma. Among the 117 amputations in these cases, 96 of them were either completely or partially amputated by the force of trauma. All 96 amputations were performed surgically within 3 days after injury. Fifteen amputations were performed within 3 weeks after injury; 11 of these patients had developed evidence of circulatory gangrene, and one had extensive bone and soft-tissue infection, while in 3 a diagnosis of gas gangrene was made. The remaining 6 extremities were amputated after 3 weeks. Three of the six required amputation because of circulatory gangrene and three because of extensive osteomyelitis.

Circumstance of injury

Among 58 patients having amputations of 2 or more extremities as a result of a trauma, 48 (82.8 percent) were injured while in combat. This number is proportionately greater when compared with the incidence of amputation resulting from combat injury in a total of 699 posttraumatic amputees, among whom 442 (63.2 percent) had amputation subsequent to combat injury. In the 699 patients with single posttraumatic amputations, 257 (36.8 percent) were injured accidentally, while only 10 (17.6 percent) of 58 multiple amputees

attributed their initial injury to accidents. It is of interest that 7 of the 10 accidentally injured double amputees were on leave or liberty at the time of injury and that 5 of the 7 were involved in train, trolley, or subway accidents. It is of further interest that 9 of the 10 accidental injury cases are classified as major-major amputees. The remaining accidentally injured major-minor amputees had forearm and partial hand amputations as a result of being struck by an airplane propeller while on duty.

Traumatic agents

The instruments which inflicted trauma to the 58 posttraumatic multiple amputees were as follows: Mortar shell fragments 15; other shell fragments 9; grenade and land mine explosions 9; deck heave 6; bombs and suicide plane explosions 7; trains, trolleys, etc. 5; airplane accidents 2; bullet wound 1; frostbite 1; accidental shell explosion 1; and crushing between ships, 1. Probably the most mutilating injuries were those sustained from bombs, suicide planes, railed vehicles, and deck heave or subsurface explosions. The latter type of injury occurs when a ship is suddenly driven upward by the force of a torpedo, mine or shell explosion. This force, if taken in the erect position, tends to produce either knee disarticulation or multiple fractures about the knee, with frequent resultant rupture of the popliteal artery.

Surgical considerations

While it has been our policy in all amputees to preserve all functional stump length, the consideration in double amputees accentuates conservatism. Reamputations are performed only if length interferes with prosthetic mechanism or if for any reason conversion to a higher level of amputation offers greater functional use. When reamputation is unnecessary, revision is performed in the routine manner.

In four patients, reconstructive operative procedures have been planned and are now underway in two of them. Of the two patients not yet operated upon, one has refused reconstructive procedure, and the surgical treatment has not yet begun in the other. Reconstruction in these particular cases consists of applying a tube graft to the stump end and later grafting a bone peg into the bony stump. Such a procedure is now underway with the triple major amputee whose arms are off at the axillae. On the right side a tube has been formed, into which a bone graft will be placed. This will offer greater leverage in controlling his arm prosthesis.

Joint contractures are prone to occur in short stumps. This is particularly troublesome in short thigh amputations which tend to become flexed and abducted. In one patient with very short bilateral thigh amputations, considerable difficulty has been encountered because of this. In much the same manner, patients with very short arm stumps have very little range of motion and inadequate length to permit sufficient leverage to control their prostheses.

Prostheses

No attempt will be made here to describe the fitting or type of prostheses indicated in amputees; however a few features peculiar to double amputees will be mentioned briefly.

A person who has lost both hands is indeed conspicuous, and without prostheses is usually unable to perform the simple functions of daily life unless his environment is adjusted to his acquired deformity. However with the use of hook prostheses, these amputees can develop a high degree of self-sufficiency in life. These patients rarely use an artificial hand, but are inclined to rely upon the more conspicuous but useful split hook. Cineplastic operative procedures, followed by proper fitting with a prosthesis which can be controlled by flexor and extensor muscle pegs, may offer a greater degree of control to bilateral forearm amputees. One of our patients has been fitted with a cineplastic hand, but at present still prefers to use hooks with cross shoulder control.

A hook is unquestionably a more useful tool than an artificial hand, but in those cases where a complete normal hand remains, the artificial hand may offer sufficient function and enough cosmetic appeal to be preferred. When crutches are used, an artificial hand is somewhat better than a hook.

Bilateral leg amputees find difficulty in securing balance when they first start to walk. However this soon is accomplished, and as thigh and knee strength increases, their walking improves rapidly.

Bilateral thigh amputees at this hospital are first taught balance and thigh control by means of straight, short, thigh boots on buckets. Four patients have used these before graduating to complete legs. Three of the four have become quite efficient boot walkers. When bilateral thigh amputees are finally measured for full-length legs, their height is reduced by 1 or 2 inches by making the legs shorter than their amputated legs. This permits a greater degree of balance and control.

Associated injuries

Concomitant injuries associated with amputations of 2 extremities occurred in 43 cases. Twenty of these patients had fractures, in 5

of whom the break was simple and in 15 compound. One of the 5 had a simple fracture which was considered ununited 4 months after injury. In this patient, who was our only triple amputee, open reduction and plate fixation were done. Three of the patients with compound fractures developed osteomyelitis, which, in the patient with bilateral Chopart amputations, involved both tibias. Five of the double amputees lost one eye, one of whom was partially blind in the opposite eye. Four patients suffered ruptured tympanic membranes at the time of injury and three sustained nerve injuries. The remaining injuries involved only soft tissue and were healed when the patients were admitted here. The more severe injuries serve to complicate further the management of these double amputees, so that hospitalization is prolonged and readjustment to life delayed. (See Article VI in this Symposium—EDITOR.)

Mental attitude

While double amputees have a proportionately greater adjustment to make in terms of their functional loss than their fellows who have only one amputation, they nevertheless appear to show a more rapid acceptance of their loss and face the future with a greater and more cheerful determination. In some of them, the outward appearance is deceiving and merely serves to camouflage a turbulent state of unrest. This is particularly true in those who are unable to get about. However, this incapacity produces a great anxiety and determination to walk alone. For this reason they keenly anticipate the day when they will receive their prostheses. Once walking is begun, they display untiring effort and great satisfaction in their accomplishments. Whether this enthusiasm to overcome their incapacities will continue into the future depends chiefly upon the individual's intelligence, stability of character, and determination. Among the 33 major-major amputees, 2 are definitely depressed but are improving; 1, who lost his feet as a result of frostbite following attempted suicide, was temporarily uncommunicative and somewhat paranoid. The remaining patients, including the triple amputee, all display unusual courage in adjusting to their loss of functional activity.

At present, six of the major-major and two of the major-minor amputees have been discharged. Eight of the major-major patients still in the hospital are now using completed prostheses. While a few of the remaining patients also have their prostheses, the majority of them are still under active surgical treatment.

SUMMARY

Among 769 amputees, 58 had amputations involving 2 extremities and 1 suffered partial loss of 3 limbs. By virtue of their amputations, at least 42 of these patients have considerably greater incapacities than single amputees. Bilateral thigh amputations were done in 1 patient because of Buerger's disease. The remaining 58 multiple amputees lost their limbs as a result of injury. Combat injuries were more frequent than accidental. Accidental injuries occurred during leave or liberty in 7 out of 10 cases. Ninety-six of the 117 amputations resulting from trauma were performed within 72 hours after injury. Fragments from projectiles, train accidents, and explosions, both surface and subsurface, produced the primary injury in most of the cases.

Surgical and prosthetic considerations are discussed briefly in terms of specific problems of the multiple amputee. Associated injuries tend to incapacitate further the double amputee and prolong hospitalization.

Generally the mental attitude is above average among the double amputees.

VIII. THE MANUFACTURE OF PROSTHESES BY NAVAL PERSONNEL

BASIL PETERS
Lieutenant H(S) U.S.N.R.

The history and development of prosthetic management at this amputation center furnish material that may be of considerable interest to various professional groups. Concerned as it is with the closest cooperation between surgeon and orthopedic technician, the field of prosthetic management in the Navy has produced some significant and far-reaching results, both theoretical and practical. A healthy experimental attitude has prevailed, and valuable lessons have been learned in terms of materials employed, methods of fitting, and procedures of construction. The following is a description of prosthetic management here according to experience with the problems and procedures involved in the manufacture and fitting by Naval personnel of over 500 prostheses.

Development of the artificial limb shop

The story of the development of the artificial limb shop and its personnel has been told in detail in the first article of this series on amputee rehabilitation. Begun in January 1944 the building was sufficiently advanced and equipped by May to start the training of personnel. In that month the writer, a technician with 20 years of experience in the making and fitting of artificial limbs, and since 1941 engaged in the development of plastic limbs at a concern in New York City, was commissioned Ensign H(S) U.S.N.R., and placed in charge of the limb shop. By July a staff of 12 men had been assembled from service personnel, none with previous experience in limb making, but with cognate skills in working with the materials used, and sufficiently trained to start production. Twelve prostheses were completed in July 1944. In December the output reached 30 for the month. Personnel was increased by February 1945 to its present number, 25, and the monthly output since June 1945 has varied from 50 to 55.

Temporary versus permanent prostheses

Temporary pylons or provisional prostheses, so-called, were in use as early as 1914 and were employed to assist the numerous amputees of the last war who were awaiting permanent limbs. Theoretically

a temporary prosthesis is fitted to enable the amputee to recover the function of locomotion and to stimulate the regressive development of the stump. However experience has shown that temporary pylons which are not made in entire conformity with scientific rules for fitting prostheses—and they seldom are—often cause difficulties when undertaking a permanent fit. The pylons are usually very heavy, and this fact, combined with faulty alinement and fitting, results in improper gaits and postures, easily acquired but difficult to correct.

The method instituted at this Naval hospital avoids the prolonged period of waiting for a prosthesis, thereby eliminating the need for temporary pylons. When the stump is healed, and in many cases prior to complete healing, the patient is measured for an appliance. Two to four weeks after the stump is healed, the patient receives his prosthesis. The provision of an artificial limb made with materials of a permanent nature, fitted and alined properly, with the limb following natural symmetry as closely as possible, offers the patient the basic foundation for the type of prosthesis he will have to wear the rest of his life. If within a few weeks the stump undergoes rapid regressive development and thus becomes too small for the socket, a new socket is fitted to the stump and the change-over accomplished without altering the original alinement of the limb. This procedure takes only 24 hours for completion.

The use of plastic material

Several factors determined our use of plastic material, rather than willow or aluminum, for the construction of limbs. First, though willow was the material predominantly in use at the time, there was a critical shortage of properly seasoned wood. Second, the high priority on aluminum made it difficult to obtain in sufficient quantity. Third and most important, the lack of skilled labor and the length of time required to train personnel in procedures using willow or metal would have delayed the prosthetic program for many months. The writer's experience had convinced him that the adaptability of plastic material and the simplicity of its use in prosthetic manufacture would make it possible to train men in the methods of limb construction in a period of only 8 to 12 weeks.

The plastic material is a laminate, composed of cotton duck canvas, impregnated with Weldwood plastic resin glue. The material is laminated around the collapsible wood forms in thicknesses of 4- or 5-ply, with additional thicknesses of 2- or 3-ply to reinforce the areas of stress. The final thickness varies from three thirty-seconds to one-eighth of an inch. The plastic is a cold water mix and does not require heating or baking to cure. When the required amount of mate-

rial is laminated, it is bonded simultaneously to a recessed portion of the ankle- or knee-piece. It is then placed in a dry room at a constant temperature of 75° F. and left for 12 hours. The bonded area is 1½ inches in length. When the mold is withdrawn, the result is a plastic shin tube segment, firmly bonded to the ankle- or knee-piece; no screws, bolts or rivets are necessary.

Plastic versus other materials

In comparing the characteristics of plastic with other materials used for the manufacture of prostheses, it is our experience that plastic offers the greatest advantages obtainable. Leather is apt to mold under certain conditions, and wood, not being moisture-resistant, is subject to cracking. The improper welding of aluminum results in weak spots; moreover metal contains sound-conducting qualities which constitute a major annoyance to wearers of artificial limbs. Fiber is the heaviest material used and requires unsightly seams, riveted throughout the length of the limb. Plastic on the other hand is workable with ordinary wood tools. It is as light for its strength as any other material and is extremely durable. It is waterproof.

Prostheses manufactured at U. S. Naval Hospital, Philadelphia, May 1944 to 19 October 1945

<i>Amputation sites</i>	<i>Number</i>
Total or partial toe.....	11
Partial foot (Chopart or Lisfranc).....	18
Syme's (disarticulation of ankle).....	3
Below-knee	128
Gritti-Stokes (end-bearing)	13
Above-knee	144
Disarticulation of hip.....	2
Total or partial finger.....	16
Partial hand	2
Disarticulation of wrist.....	7
Below-elbow	80
Above-elbow	82
Disarticulation of shoulder.....	7
Total	513

Bilateral cases (included in foregoing)

Below-knee	6
One leg and one thigh.....	4
Above-knee	5
Forearm	2
Total	17

moldproof, smooth to the touch, and, when properly cured, induces no toxic reactions. In summary, plastic offers the ideal qualities and characteristics desired in the manufacture of artificial limbs.

Ease of adjustment

The matter of adjustment in the fitting or alinement of plastic limbs offers no problems. If after wearing the limb the patient requires easing of the socket, this is done with ordinary cutting tools. When the site is the thigh, a new socket may be fitted and readily inserted into the thigh segment at the most suitable section. In a below-knee prosthesis, the socket is removed and a new one is inserted into the shin tube. The lengthening or shortening of limbs, and toe-in or toe-out adjustments, can be accomplished by changes made at the sections of the ankle-base or the knee-piece.

Analysis of prostheses made

A total of 513 prostheses have been manufactured at this activity in a period of 18 months, ending 19 October 1945. The table on page 107 presents an analysis according to the sites of amputation.

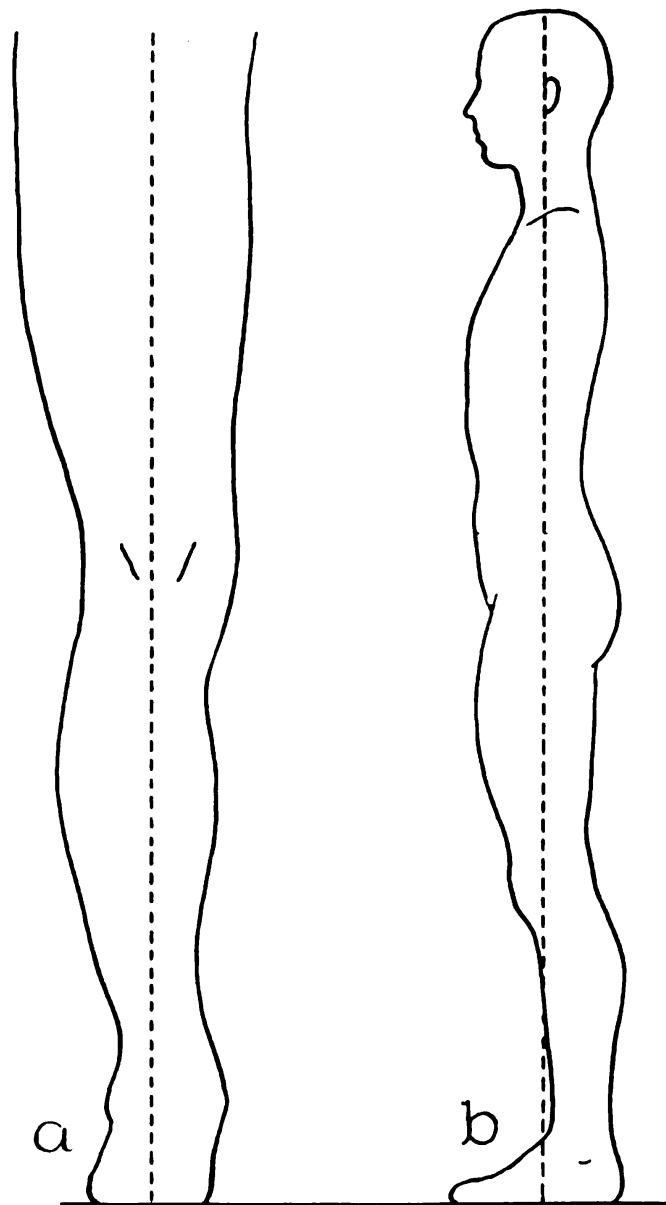
SCIENTIFIC PRINCIPLES IN LIMB FITTING

The scientific manufacture of artificial limbs is governed by the laws of human statics and by the individual characteristics of the patient to be fitted. First, the angles of declination and inclination of the lower limb vary with the height and breadth of the patient; therefore the artificial limb must be adapted to the anatomic structure of the amputee. The three segments of the limb should be so superposed that the bearing foot is near the median plane (fig. 1a). Second, the vertical line passing through the center of gravity of the body should fall behind the axis of the hip joint and in front of the axis of the knee joint, crossing the arch of the foot at its summit (fig. 1b). Thus the positional relationship of the three axes, ankle, knee, and hip, secure both perfect rigidity and free movement of the constituent segments of the limb.

The dynamics of the limb will depend on the alinement, and the appliance will be much more efficient if it conforms to the dynamic and static functions which it has to perform. In locomotion, when the bearing foot is placed in the median plane or very near it, the result is a graceful and easy gait which is not fatiguing. (When the bearing foot is out of the median plane, there is a marked lateral displacement of the body which is most fatiguing and ungainly.) Normal stance is achieved with a minimum of muscular contraction.

The arrangement of the axes of the ankle, knee and hip is led by

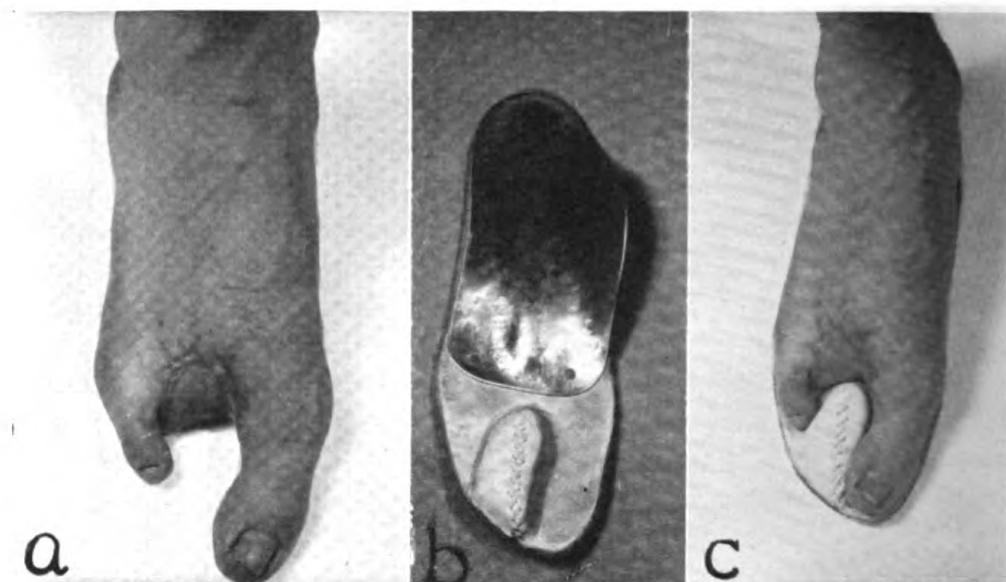
1. Diagram illustrating normal variation from a perpendicular axis.



force of gravity to maintain the artificial limb in a position of extension on the thigh. Thus although it is composed of two mobile segments, the limb remains rigid without the use of any active mechanism. In walking, stability in the transverse plane is secured by eversion of the foot. The angle of eversion varies with the subject, and it is important that the foot be rotated outward on the leg at an angle similar to the normal foot.

THE FITTING AND CONSTRUCTION OF LIMBS FOR THE VARIOUS SITES OF AMPUTATION

The following presents certain of our experiences in the fitting and construction of prostheses. This is done in groups according to



2. Partial toe amputation with prosthesis.

the site of amputation involved. In each group, illustrative and illustrated case reports are cited, since the individual problem always supersedes prosthetic dogma, and a visual record most effectively tells its story. When called for, there are discussed in each group, or under individual cases, items of practical importance in fitting and making the particular prostheses.

Partial or total amputations of toes

Eleven cases of partial toe amputations were fitted with appliances.

Case 1 (Amputee No. 299): Three toes were amputated, the big toe and little toe remaining (fig. 2a). A plaster impression was made of the amputated foot. The appliance consisted of an 18-gage stainless steel foot plate, with a leather and felt forefoot segment attached to replace the amputated portion (fig. 2b). The felt segment prevents the toes from drawing together (fig. 2c).

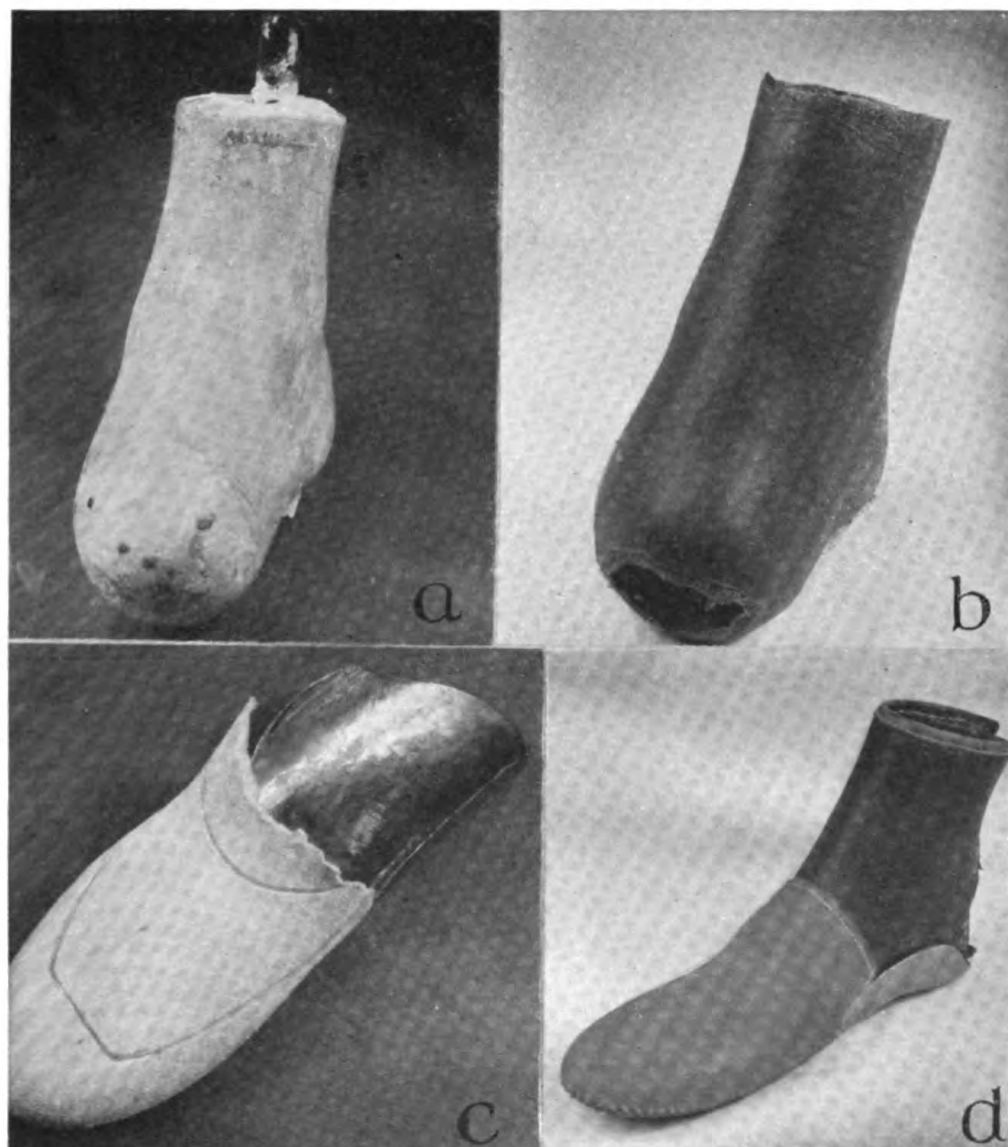
Partial foot (Chopart or Lisfranc) amputations

Eighteen patients were fitted with appliances.

Case 2 (Amputee No. 528): A plaster form was made of the amputated foot (fig. 3a), and measurements were taken as in figure 4. This appliance consists of an 18-gage stainless steel (Whitman) foot plate, with a hard cushion felt forefoot segment to replace the amputated portion (fig. 3c). A 6-ounce russet leather anklet lined with horsehide is molded around the plaster form (fig. 3b) and attached to the foot plate. It laces in the back (fig. 3d). Care was taken to prevent any undue pressure over the anterior end of the stump.

Disarticulation at ankle (Syme's)

Three Syme's appliances were fitted to patients.

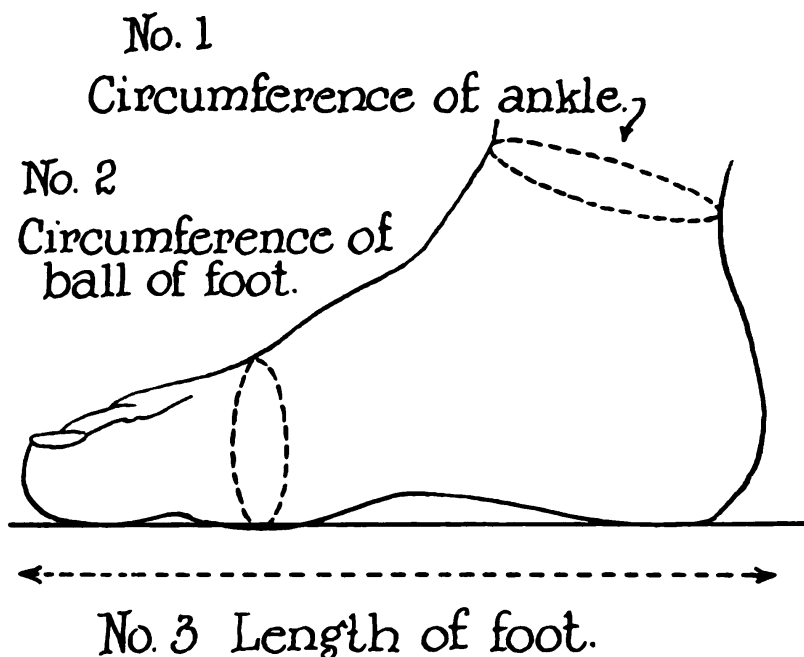


3. Prosthesis used for transmetatarsal, Chopart's and Lisfranc's amputations.
a. Plaster cast of stump. **b.** Leather socket molded on cast. **c.** Metal foot plate (Whitman) with a felt extension. Extension replaces forefoot. **d.** Assembled prosthesis. Laces posteriorly.

Case 3 (Amputee No. 441): A plaster form was made of the stump (fig. 5a). With the use of an ankle joint with side-bar attachment (fig. 5b), it was possible to construct a simple and sturdy appliance permitting normal articulation of the ankle at the proper level (fig. 5d and e). Due to the bell-clapper shape of the stump, the socket, when laced tightly around the stump, does not tend to slip off or loosen, and the ring-top socket gives a very effective support at the level of the tibial condyles (fig. 5f).

Below-knee amputations

One hundred twenty-eight patients were fitted with below-knee appliances.



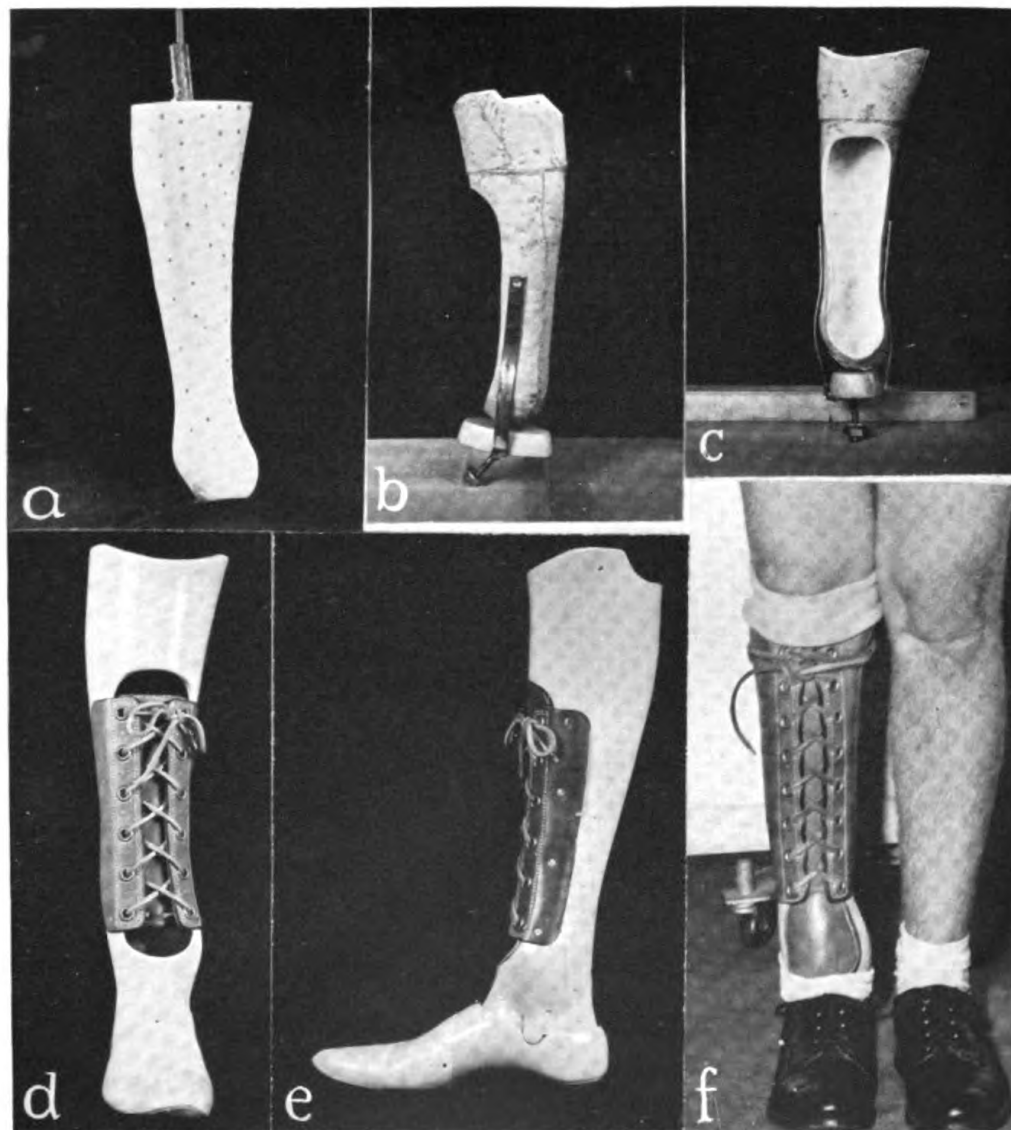
For partial toe amputation ~
no measurements taken.

For Syme's amputation ~
ONE measurement :
from end of stump to floor ~

4. Measurements for partial foot prosthesis.

Case 4 (Amputee No. 460) : Amputation of the stump was 3 inches below the hamstring insertion. Measurements were taken as in figure 6. A cast of the stump was made to show locations of prominent bones, scars, and other important features, then built up accordingly (fig. 7b). After fitting, side knee joints were attached slightly ahead of the center of the socket (fig. 7c and d), which in turn was inserted and bonded into the shin tube (fig. 7a). An 8-ounce russet leather corset lined with horsehide was attached to the upper bars of the knee joints for thigh support. A slipper-type foot was used as shown in figure 8.

In fitting a below-knee limb (fig. 9c), ample space must be allowed for all bony prominences, with particular attention paid to the head of the fibula. Care is taken to avoid pressure in the popliteal area; the posterior border should extend as high as possible, hugging the popliteal area, with a slight dip on each side for the hamstring tendons (fig. 9a). The lower portion of the stump should fit into the socket snugly but not tightly, to avoid any pull on the scar area. The upper bars of the side joints are curved to fit the contour of the thigh and thus serve as weight-bearing supports on the lateral surfaces of the thigh (fig. 9a and b). With poor stumps, much of the weight is

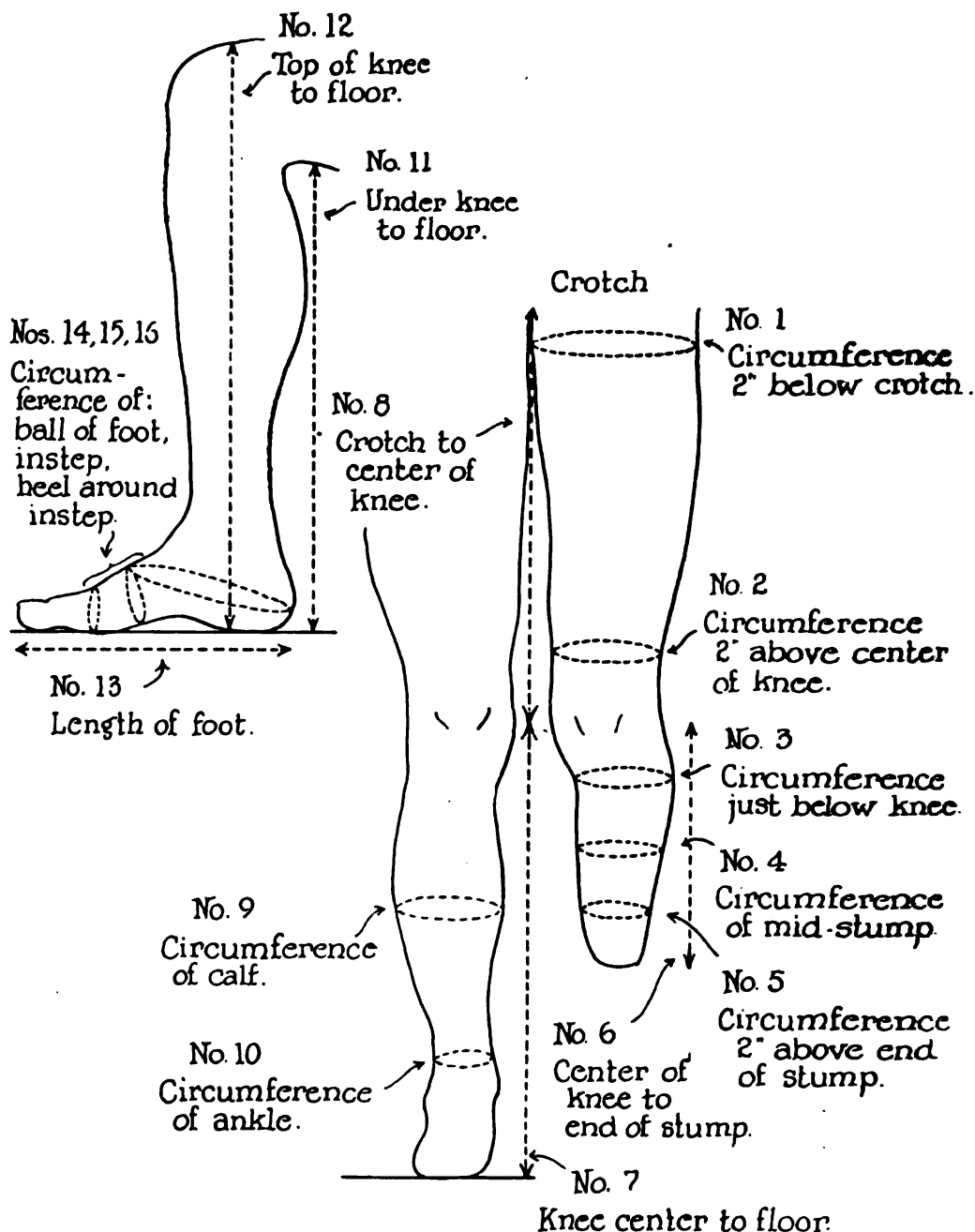


5. Prosthesis for a Syme's amputation. **a.** Plaster form of stump. **b.** Laminated plaster socket showing cutaway view of ankle base and ankle joint with side-bar attachment. **c.** Front view of laminated plastic socket. **d.** Finished Syme's prosthesis. Front view. **e.** Finished Syme's prosthesis. Side view. **f.** Patient with prosthesis.

taken on the thigh corset by extending it to the region of the ischium (fig. 9c).

"Mule" prosthesis

The stump of a leg amputated 7 inches below the hamstring insertion can oftentimes be fitted with an appliance known as a "mule" (fig. 10). No joints and corset are necessary; the weight is borne on the tibial condyles. It is lighter and can be used with greater ease and skill. Five of our below-knee amputees were fitted with this type of prosthesis.

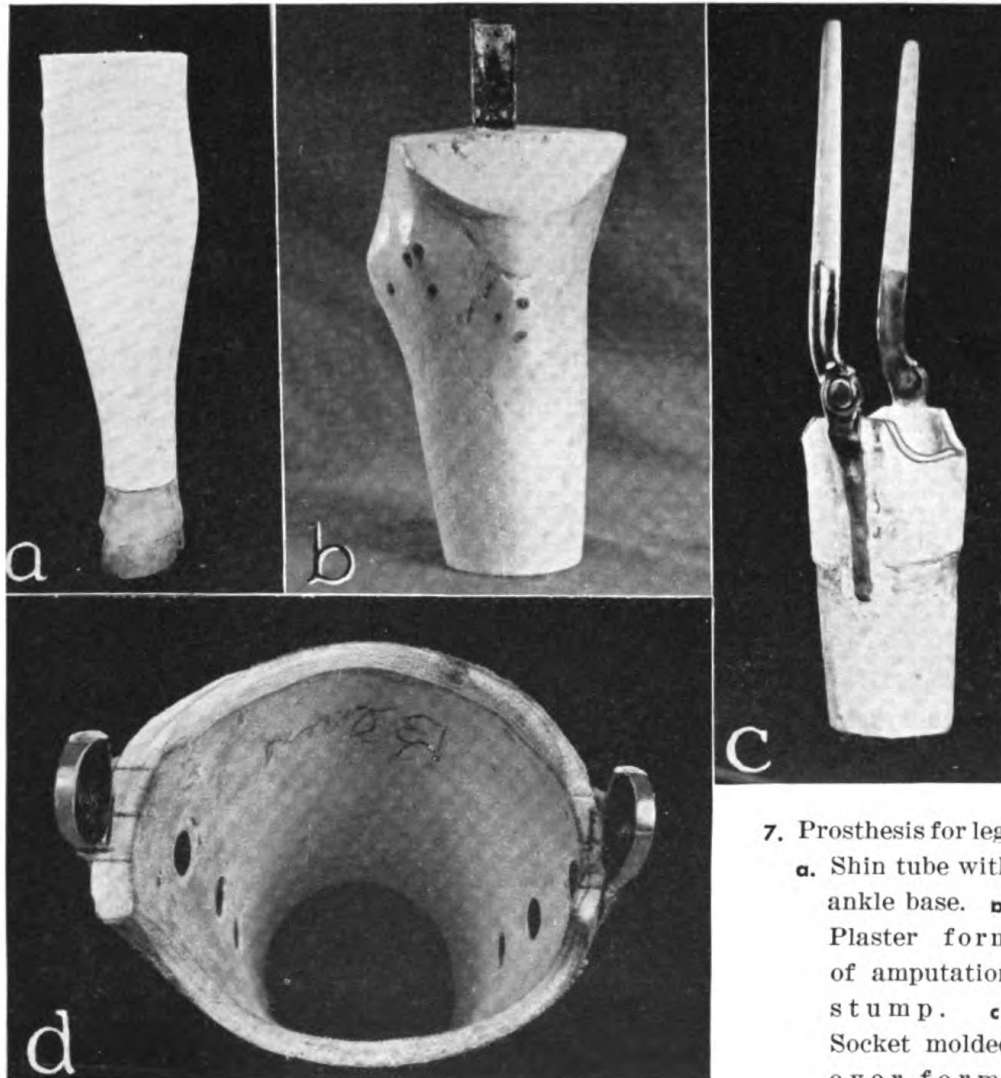


6. Sixteen measurements for leg prosthesis.

Above-knee amputations

One hundred forty-four patients were fitted with thigh limbs.

Case 5 (Amputee No. 366): Amputation had been performed at the junction of the middle and lower thirds. Measurements were taken as shown in figure 11. The shin and foot were constructed as shown in figure 12a. A combination knee-stop, knee-kicker and friction-control was attached to the shin and knee bolt as shown in figure 12b. The stump was inserted into a fitting socket placed

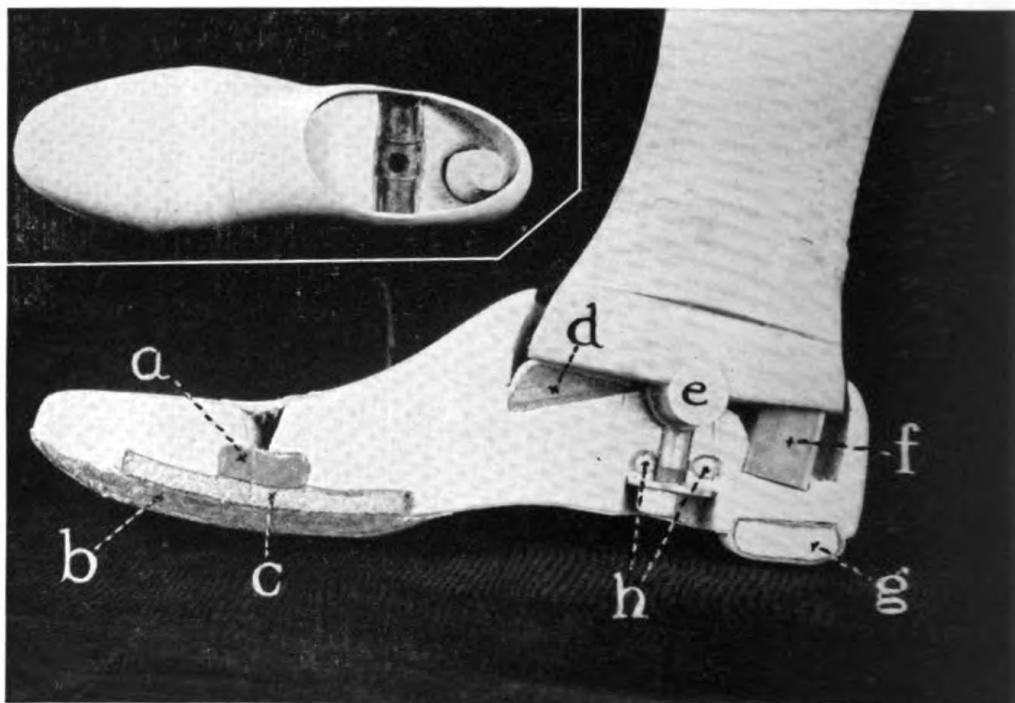


7. Prosthesis for leg.

- a. Shin tube with ankle base. b. Plaster form of amputation stump. c. Socket molded over form. d. Top view of socket.

Knee joints attached slightly anterior to knee joint of patient. This attachment varies with individual. d. Top view of socket.

on an adjustable stand, to determine the proper height and alinement. Figure 13 illustrates the proper alinement of the ankle, knee, and hip joint of the completed limb. In figure 13, *a* designates the upper level of the knee mechanism. In fitting the thigh socket, care must be taken that the weight is distributed to the anterior and posterior surfaces of the stump and on the region of the ischium. No weight is borne on the end of the stump. Ample room must be provided for the abductor tendons and for the inferior pubic region. The socket should be triangular in shape, with the apex of the triangle pointing outward over the trochanter as shown in figure 13b. As the medial border of the socket approaches the tuberosity, it widens to form the ischial seat. When fitting the pelvic joint band and belt for trial, the joint is attached to the socket so that the head of the joint is from $\frac{3}{4}$ to $1\frac{1}{4}$ inches anterior to the great trochanter and at the level of its tip. The pelvic band should be curved to fit snugly over the buttock at a level between the anterior superior spines and the greater trochanter (fig. 14).



8. Standard type foot for both leg and thigh prosthesis with a section of ankle and foot prosthesis.

- | | |
|--|---------------------|
| a. Toe rubber. | e. Ankle joint. |
| b. Felt sole and horsehide upholstery. | f. Heel rubber. |
| c. Rubberized toe hinge. | g. Felt cushion. |
| d. Instep rubber. | h. Hardwood dowels. |

Gritti-Stokes (end-bearing) above-knee amputations

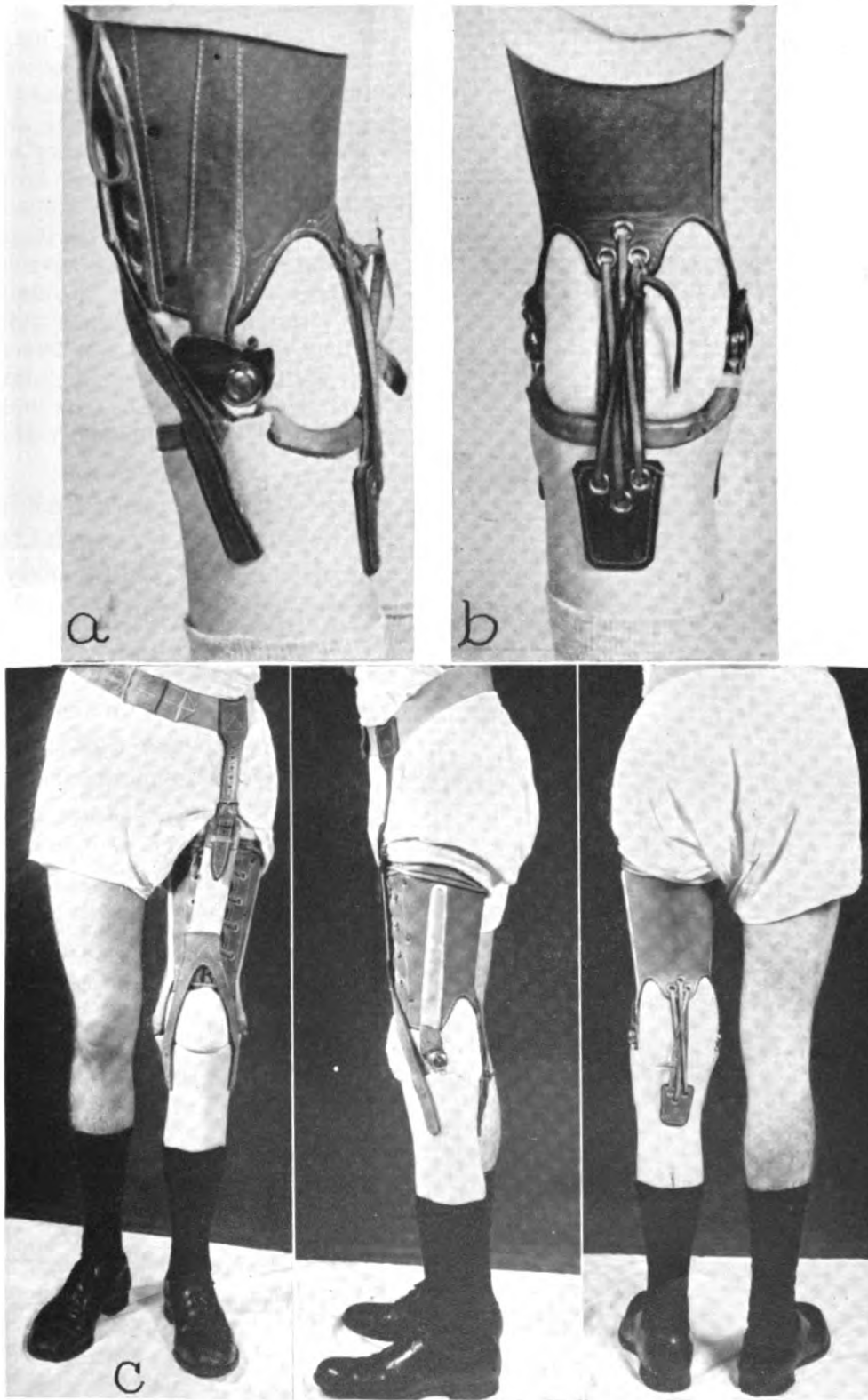
Thirteen patients with end-bearing stumps were fitted with prostheses.

Case 6 (Amputee No. 58) : A plaster form was made of the amputated stump (fig. 15b). A standard foot-shin was made. Special side knee joints were designed and forged, the lower segments resembling those of the ordinary knee bolt, the upper segments extending above the center of the joints for 7 inches and below the center for 2½ inches. Oil-less bronze washers were incorporated in the head of the joints for friction control. The socket, when fitted, was then attached to the upper segments of the knee joints (fig. 15a). The knee stop, composed of 150 strands of heavy linen thread, looped at both ends, was fastened inside the back of the shin and to the back of the knee. This is shown in figure 15c. The completed limb was suspended by means of the pelvic joint and belt, as shown in figure 16.

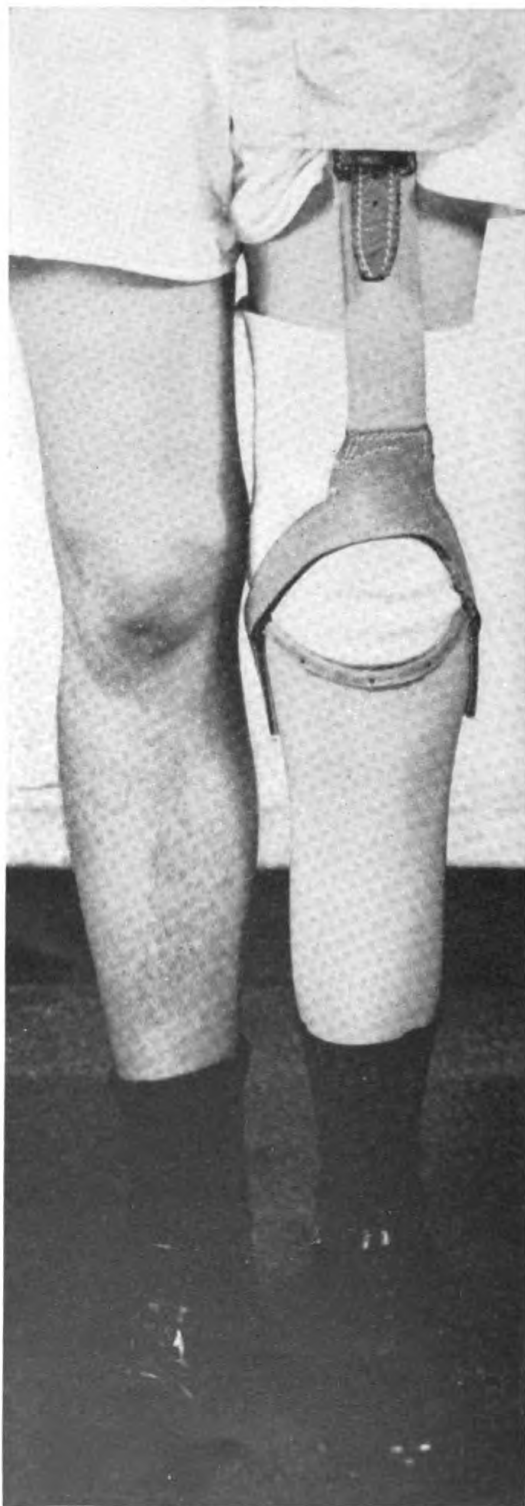
Disarticulation at hip joint

Two patients were fitted with this type of prosthesis.

Case 7 (Amputee No. 17) : A plaster form was made of the amputated hip, as shown in figure 17. A full thigh limb was constructed, with a tilting-table bucket. The bucket was made over the plaster form of the hip, using a combination of



9. a. Note fitting of posterior border of socket. b. Note proper alignment of knee joint. c. Three views of patient wearing below-knee prosthesis.



10. "Mule" prosthesis.

height of the patient was reduced 2 inches in order to increase his stability in walking and standing. Every effort was made to combine greater strength with greater lightness (fig. 19a).

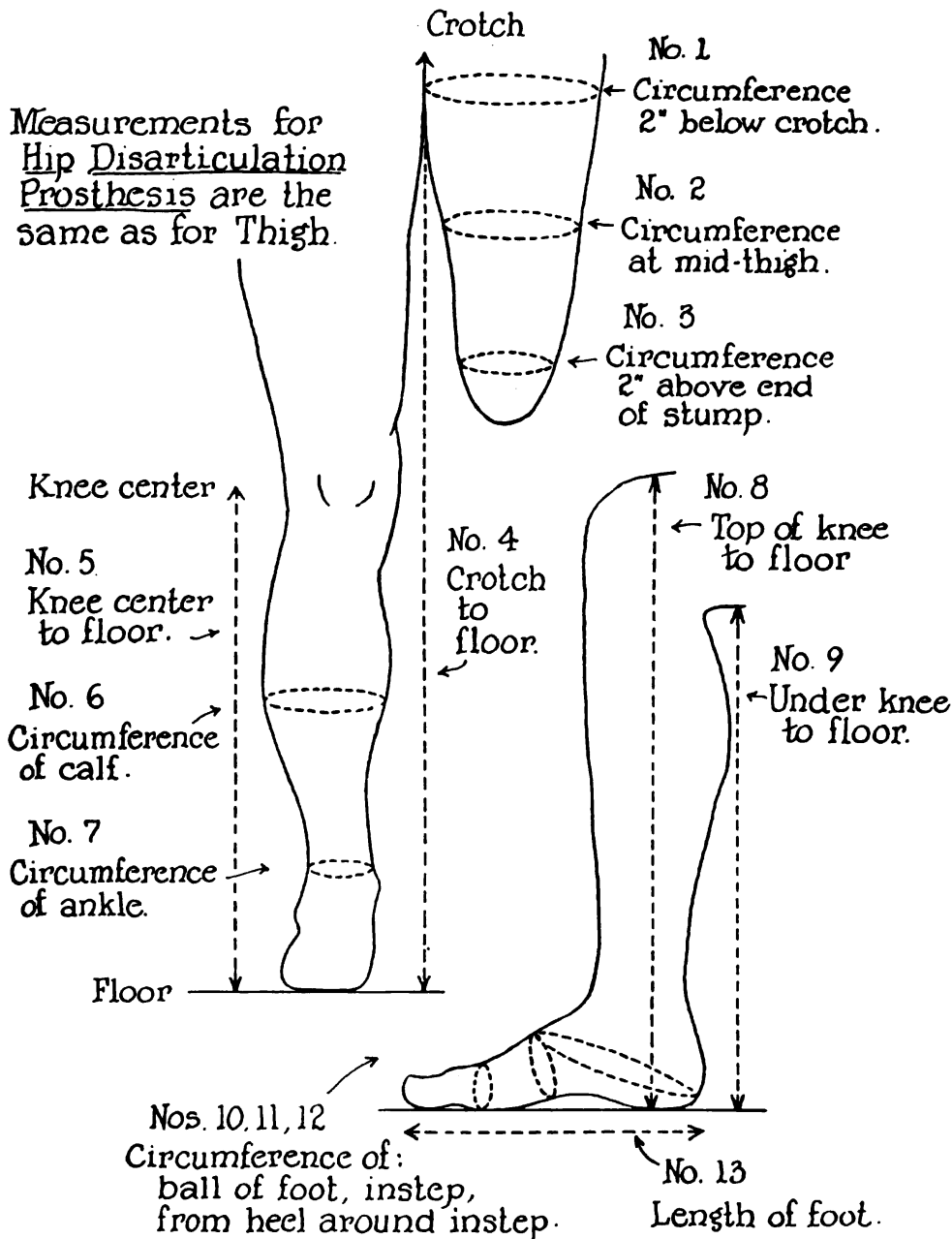
one layer of 6-ounce leather and 4-ply plastic laminate. A light metal frame was attached for reinforcement. The hip joint has an automatic push-button locking device which permits the bucket to rotate on top of the thigh only when sitting. An oil tan leather track was placed on top of the thigh piece on which the metal runner of the bucket can rotate. The limb was suspended by means of a wide leather pelvic belt, with a 2-inch web shoulder suspender for additional support (fig. 18). The limb weighed 9½ pounds without the shoe.

The adherence of the inside of the hip socket is essential to the proper support of the body. The socket should fit as snugly as possible and the bottom should be well padded with sponge rubber to provide a comfortable bearing surface. The proper alinement of the axes of the ankle, knee and hip joints secures perfect rigidity of the limb, thus eliminating the need of a mechanical knee lock and permitting the patient to articulate the knee when walking.

Bilateral below-knee amputations

Six such patients were fitted with prostheses.

Case 8 (Amputee No. 114): In general the prostheses were made similar to those described for single amputations. A more careful study of the stumps was required, especially their position, fitting of sockets and construction. The



11. Thirteen measurements for thigh prosthesis.

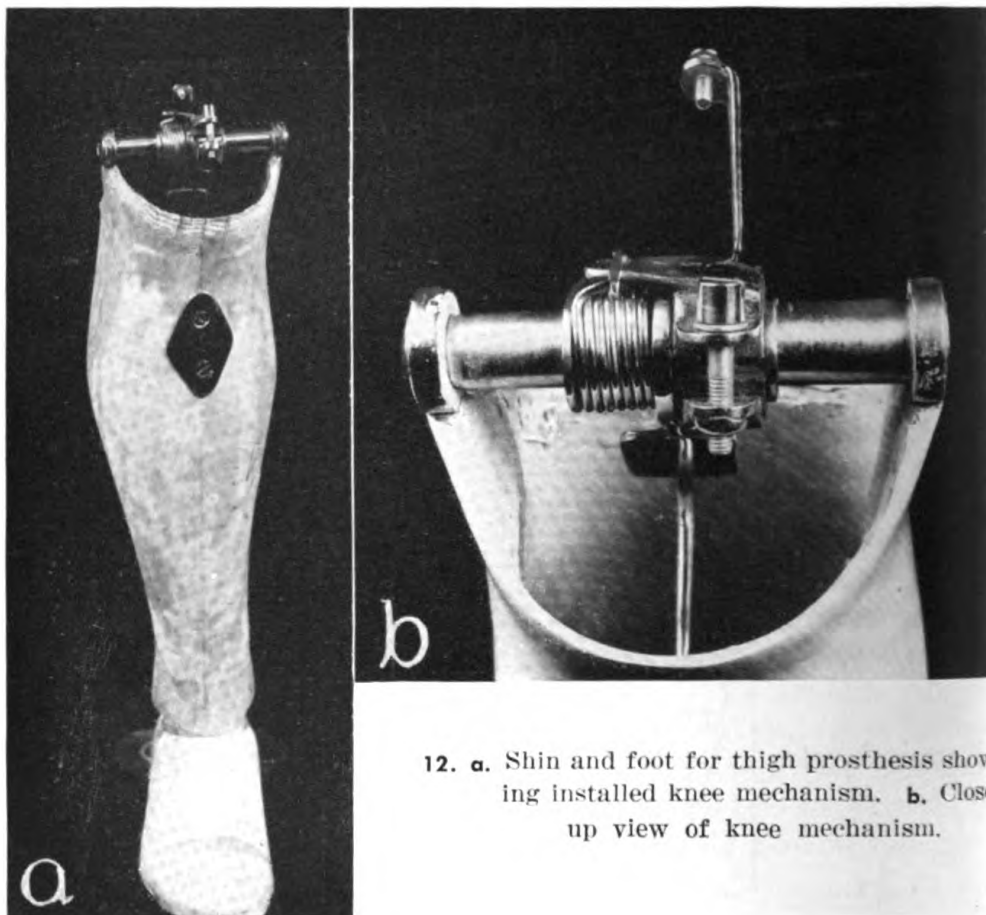
Bilateral one-leg and one-thigh amputations

Four such patients were fitted with prostheses.

Case 9 (Amputee No. 329): The same considerations as in the bilateral below-knee amputations apply for one-leg and one-thigh amputations. Particular attention was paid to the alinement of the constituent segments of the limbs. By the application of scientific principles, a perfect functional result was easily obtained (fig. 19b).

Bilateral above-knee amputations

Five such patients were fitted with prostheses.



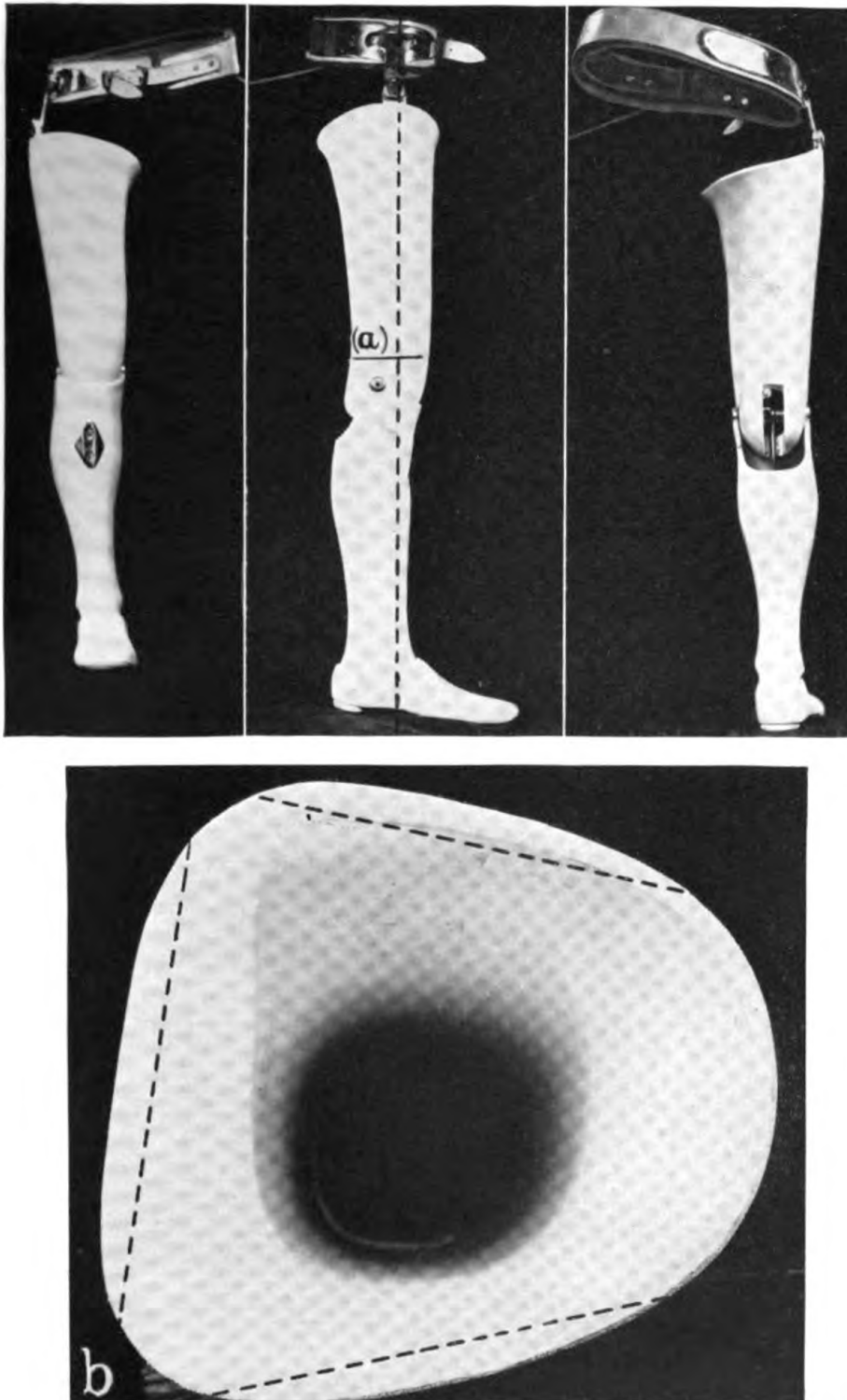
12. a. Shin and foot for thigh prosthesis showing installed knee mechanism. b. Close-up view of knee mechanism.

Case 10 (Amputee No. 1): Temporary walking boots, 18 inches in height, were fitted to the patient. As soon as the stumps were thoroughly consolidated and the patient had acquired skill and perfect equilibrium, normally articulated artificial limbs were fitted. The height of the patient was reduced 4 inches in order to increase his stability in standing and walking. It was necessary to install a knee-lock in the right limb (fig. 20), a usual requirement for a patient who finds it difficult to use two mobile knee joints.

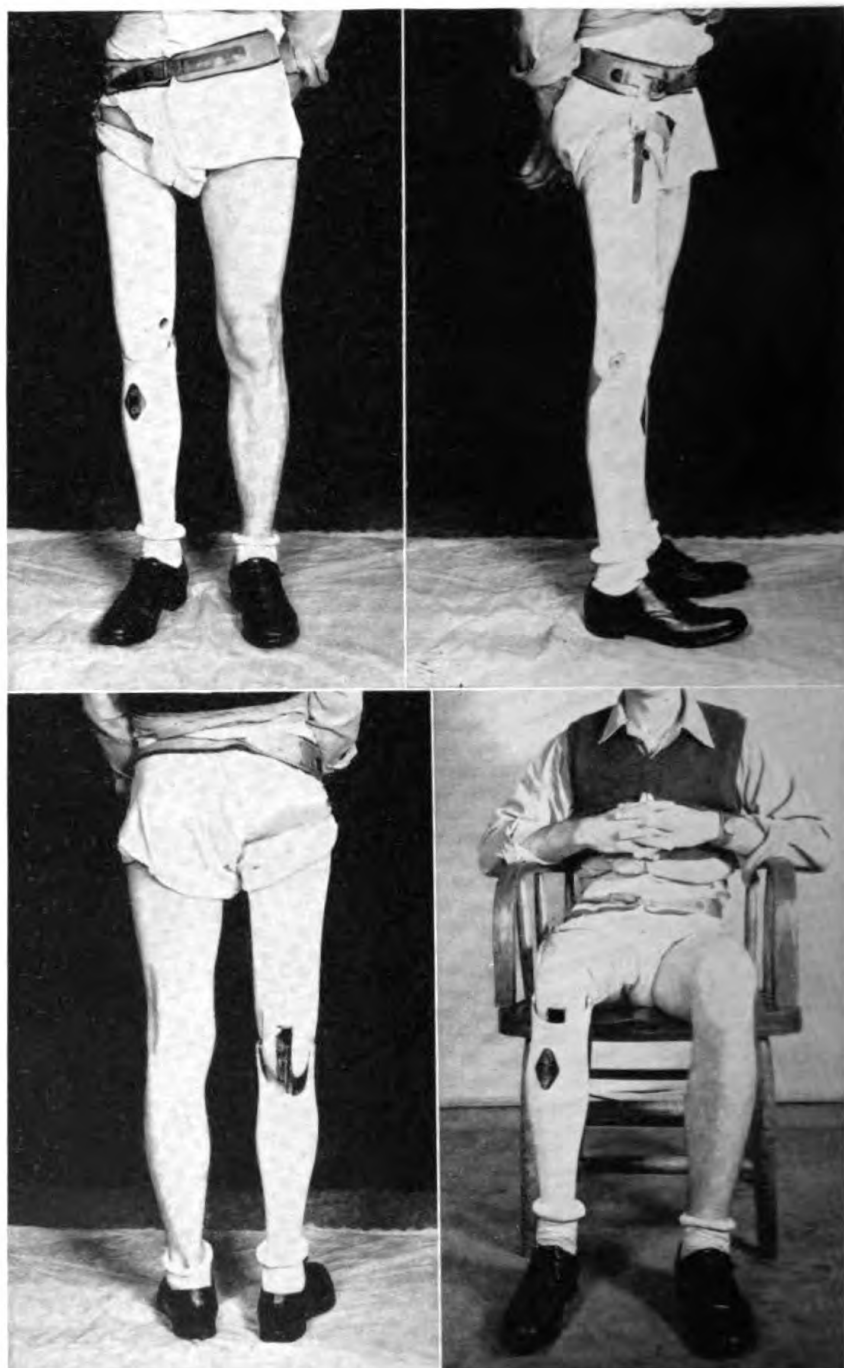
With poor short stumps it may be necessary to install locks in both limbs. If a fair amount of strength, freedom of movement and endurance are maintained in the stumps, a very satisfactory recovery of the function of locomotion can be obtained without the aid of locks. Four of the amputees in this category were fitted with limbs without knee-locks; one of these was capable of walking up and down steps only 3 days after receiving his prostheses.

Fingers and partial-hand amputations

Eighteen such patients were fitted with appliances. Prostheses for fingers and partial-hand vary according to the requirements. A combination of light plastic material and willow-wood fingers are

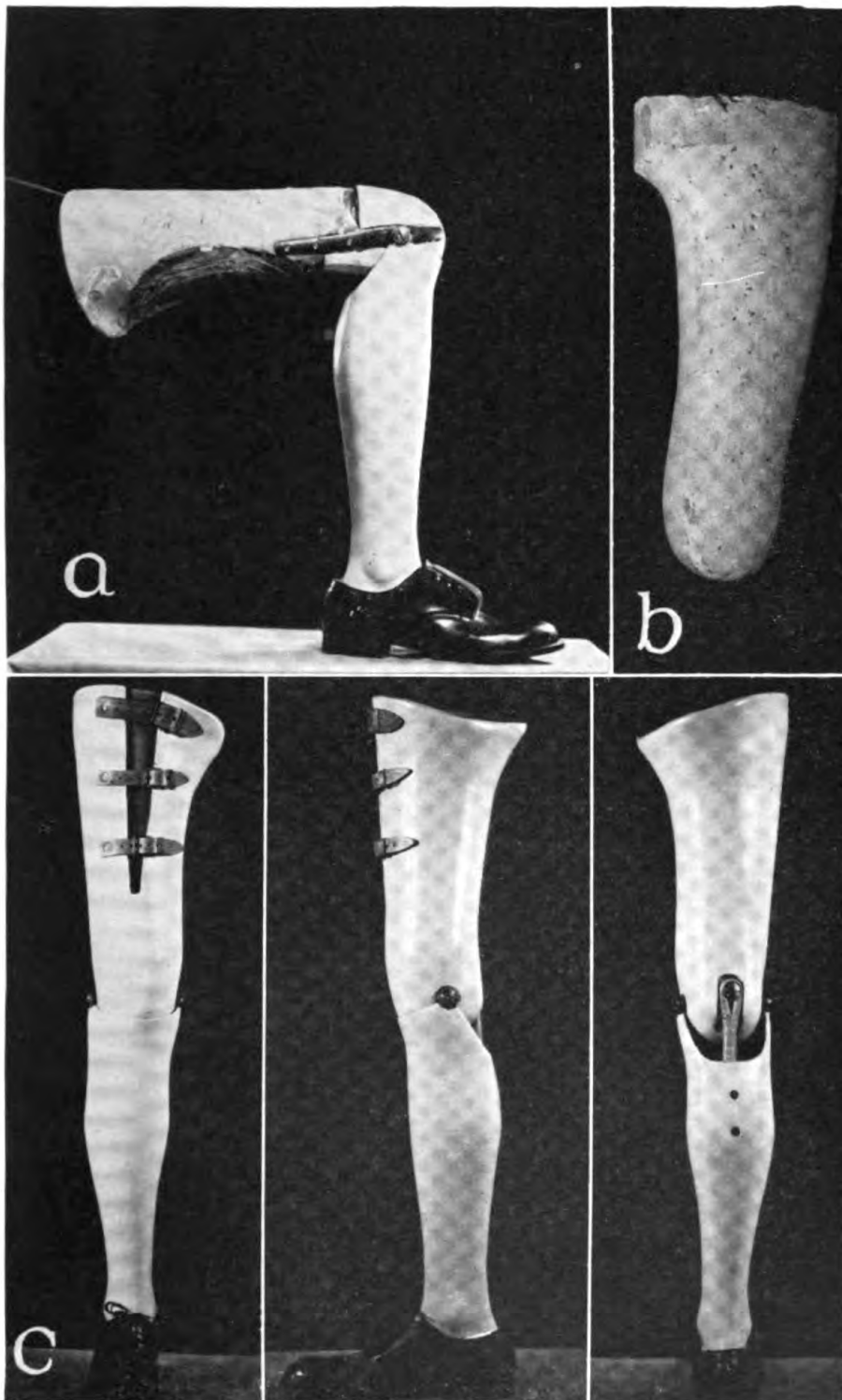


13. Full thigh prosthesis illustrating the proper alinement of hip joint, knee center, and ankle joint. **a.** Upper level of knee mechanism. **b.** Top rim of thigh socket demonstrating proper fitting contours.



14. Prosthesis for amputation at junction of middle and lower thirds of thigh.

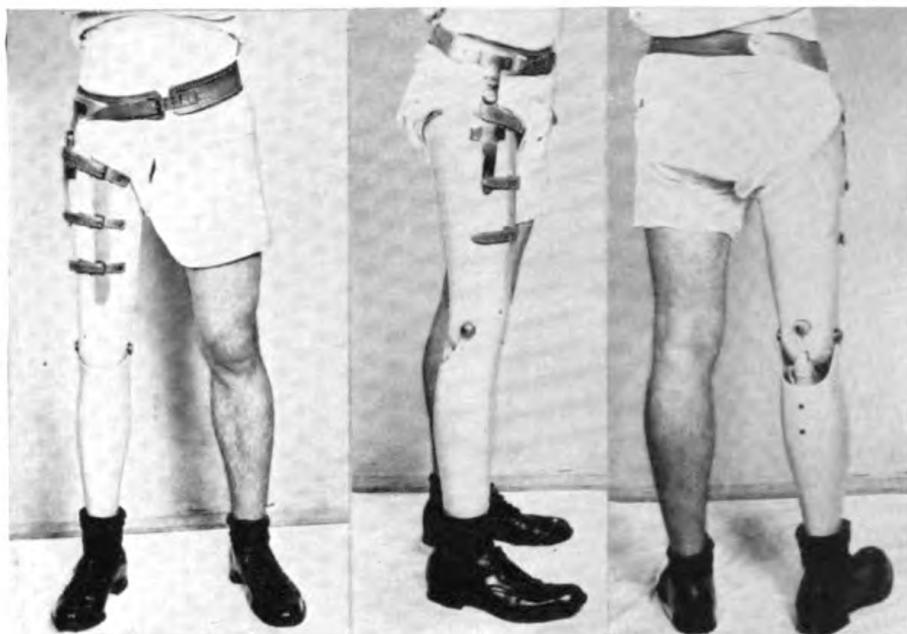
used to replace the amputated portions. These are essentially ornamental rather than working prostheses (fig. 21a, b, c). For finger-amputations, the most suitable type of working appliance is a molded leather glove to which is attached a small metal hook (fig. 21c). This appliance provides opposition for the thumb and permits the patient to carry objects.



15. End-bearing prosthesis: For Stokes-Gritti or tendoplasty amputations. **a.** Prosthesis with unfinished thigh piece showing attachment of side joints. **b.** Cast of patient's stump. **c.** The finished prosthesis.

Below-elbow amputations

Eighty patients were fitted with forearm appliances.



16. Patient wearing end-bearing prosthesis.

Case 11 (Amputee No. 218): The amputation was 2 inches above the wrist. A plaster form was made of the stump (fig. 23b). Measurements were taken as shown in figure 22. A leather socket was molded over the plaster form and attached to a metal frame. A leather corset lined with horsehide was fitted around the arm and attached to the arm side-steels (fig. 23a). A 1-inch web shoulder strap was looped around the sound shoulder and padded to prevent chafing under the armpit. One end of the shoulder strap was attached to the control cord and the other end to the arm corset for support (fig. 23c, d).

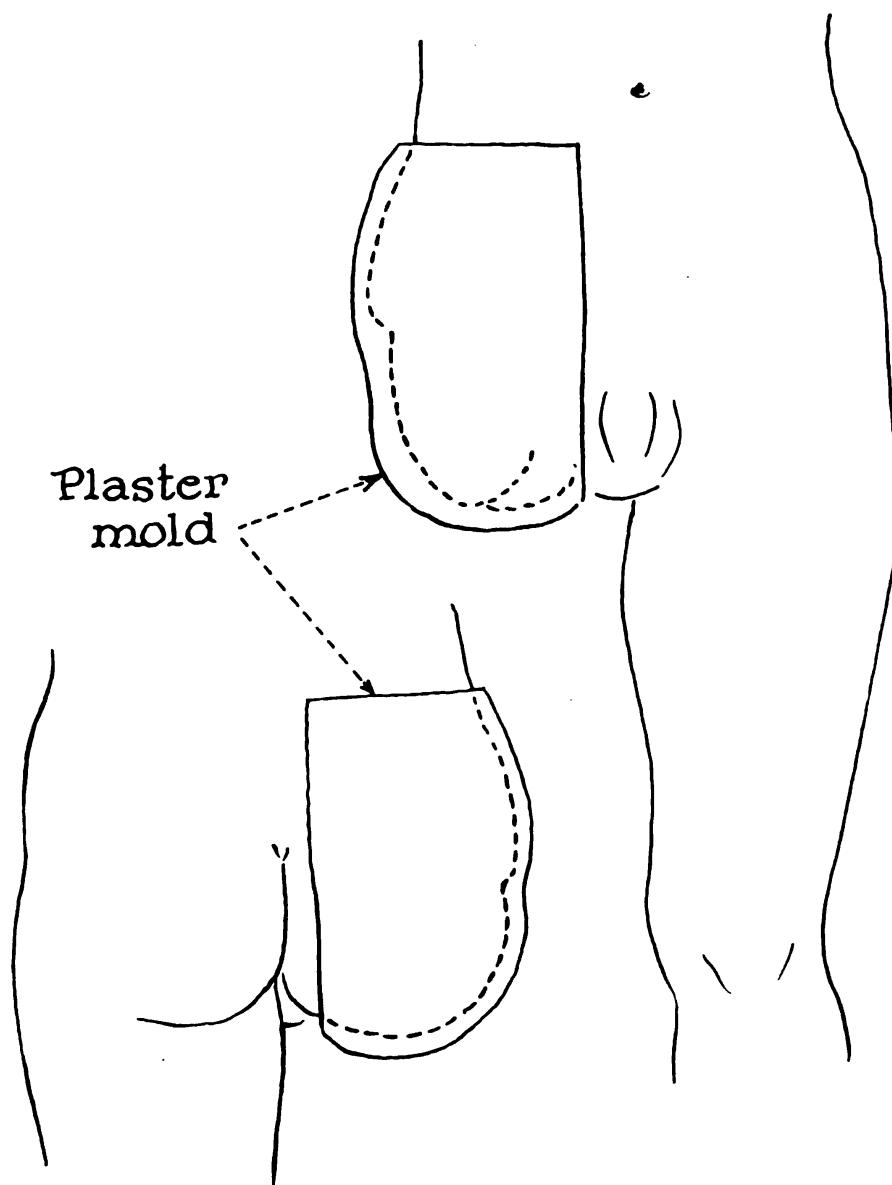
The forearm socket, elbow joints and arm corset should be fitted accurately to enable the patient to transmit the movements of the prosthesis rapidly and firmly. The attachment of the appliance should not hamper the play of the arm muscles and should allow complete freedom of movement of the elbow.

Mechanical hand and utility hooks used

Figure 24 illustrates the Miracle hand. The hand has a simple mechanical device providing for voluntary flexion of the four fingers and thumb. This is installed in the body of the hand at the region of the wrist. The body of the hand is made of cast aluminum, the fingers are of latex composition reinforced internally with metal. Figure 25 illustrates the farmer's utility hook and the round-top hook. The force in closing the hooks can readily be regulated by the number of rubber bands fixed a little above the hinge.

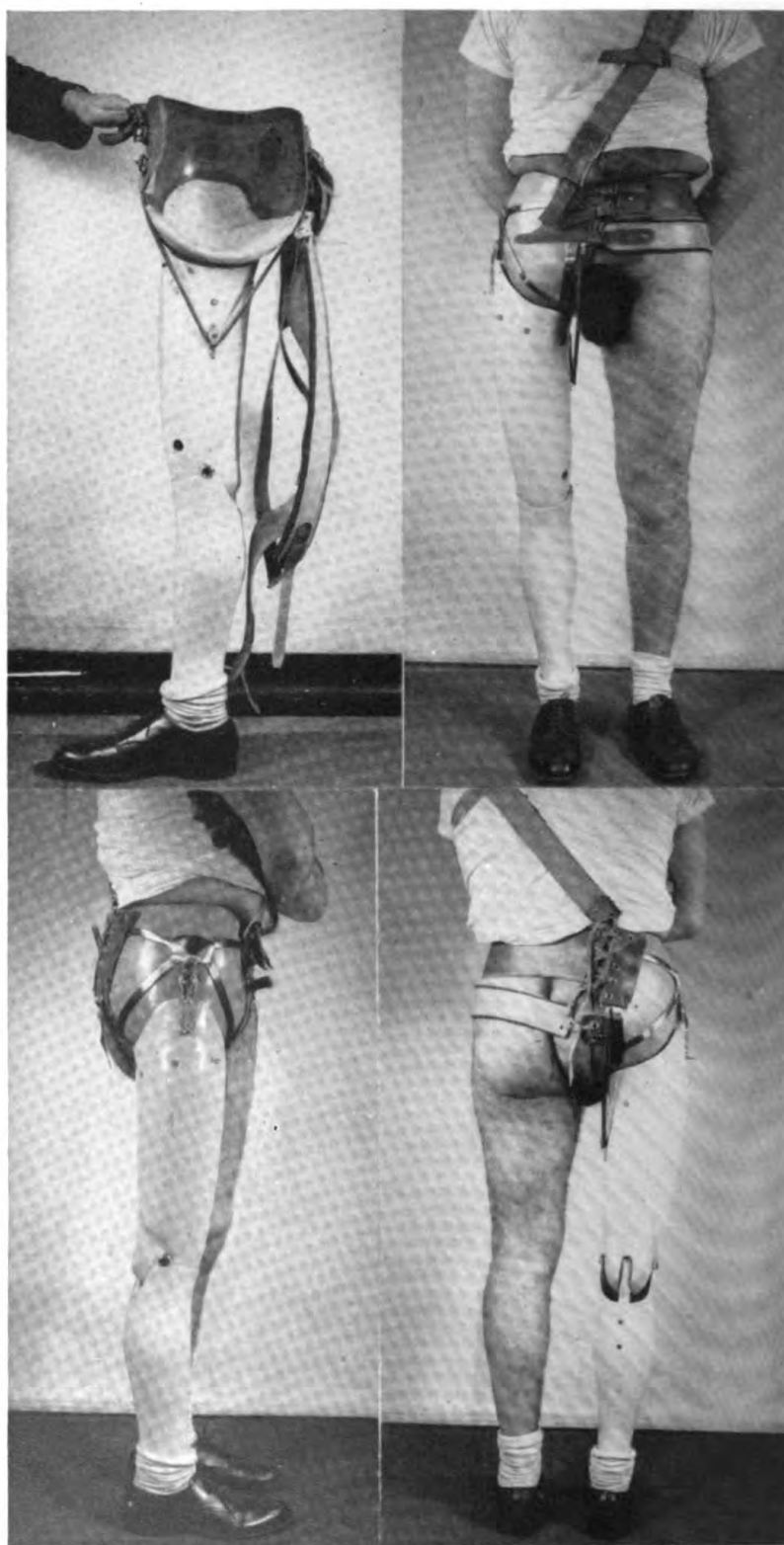
Above-elbow amputations

Eighty-two patients were fitted with arm prostheses.

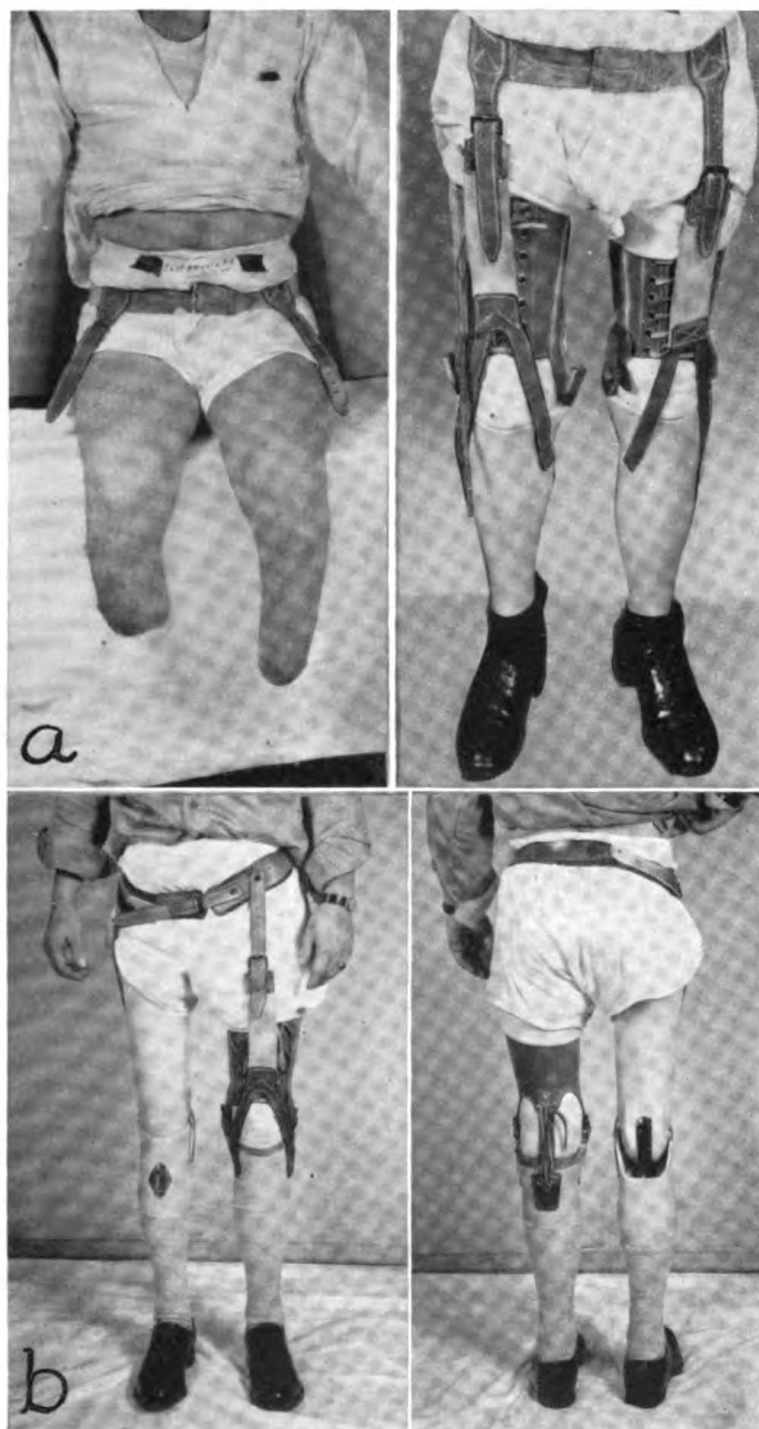


17. Disarticulation of thigh.

Case 12 (Amputee No. 498) : Measurements were taken as shown in figure 22. The forearm segment was made of 3-ply laminated plastic, with elbow bolt and straps attached to the upper portion of the segment (fig. 26c and d). The arm segment and socket was made as shown in figure 26a and b. An elbow lock was installed which permits the forearm to be fixed in a wide variety of positions in relation to the arm. The arm was attached by means of a leather shoulder cap and 1-inch elastic chest strap. One end of the looped shoulder strap was attached to the central control cord articulating the elbow, and the other end attached to the control cord articulating the hand or hook (fig. 27). The sockets for arm prostheses are rigid and should be fitted snugly to the stump. The method of attachment is the indispensable element; it should not inconvenience the upper part of the body or hamper the movements of abduction, adduction and rotation.



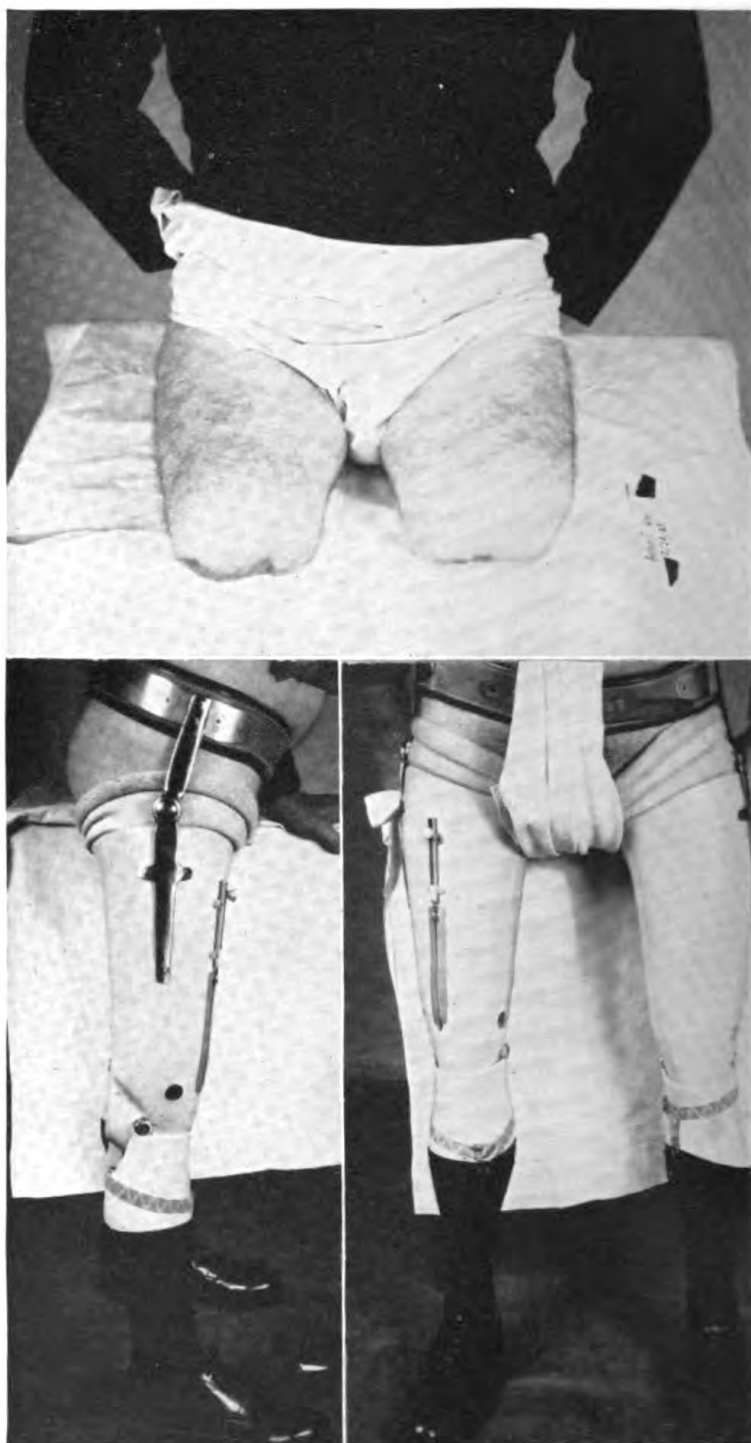
18. Medial view of tilting-table prosthesis for hip disarticulation. Patient wearing prosthesis.



19. a. Bilateral leg amputation and prosthesis. b. Patient wearing two prostheses: one leg and one thigh.

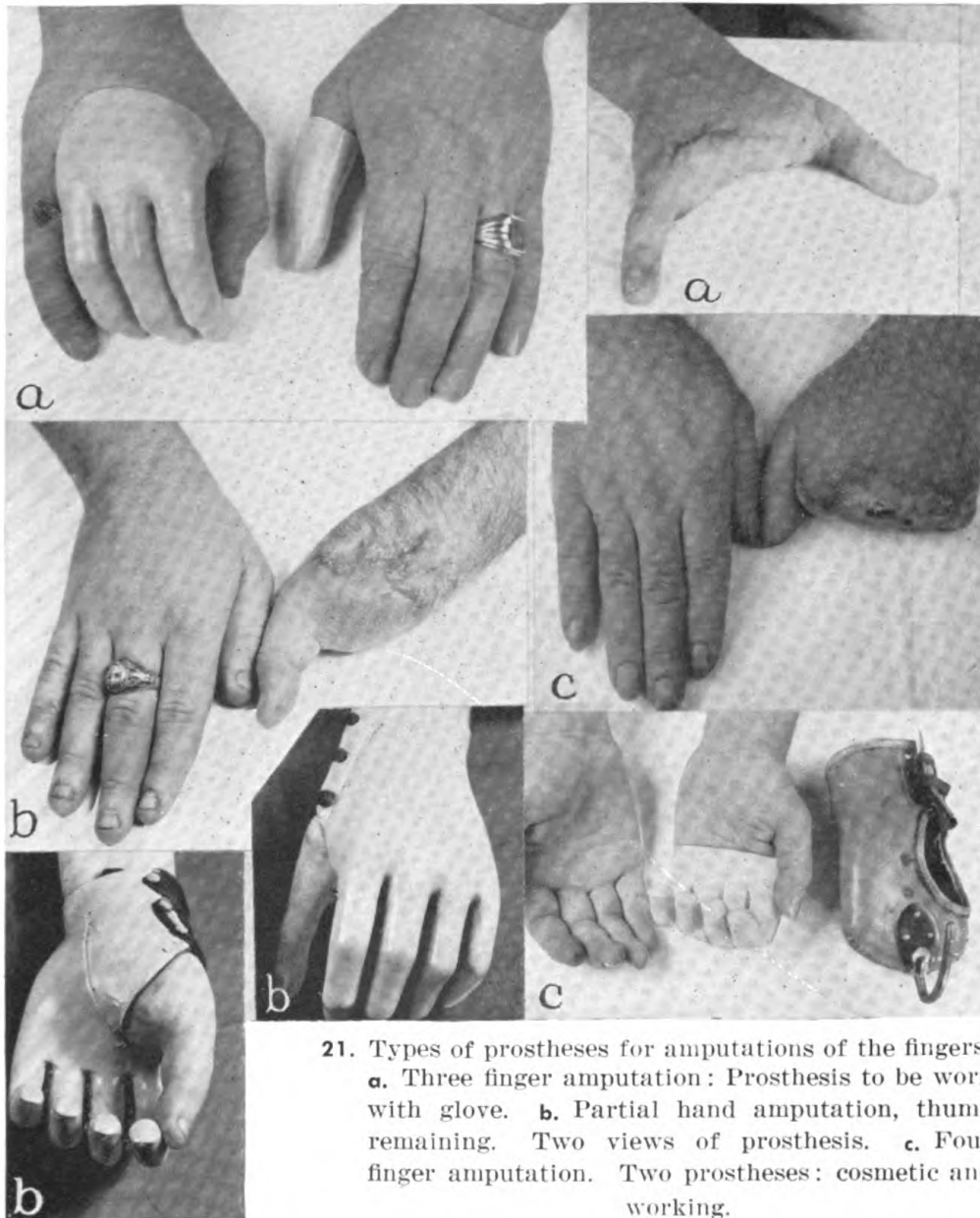
Disarticulation at the shoulder

Seven such patients were fitted with prostheses.



20. Prostheses for bilateral thigh amputation. Note automatic handlock on right limb (side view).

Case 13 (Amputee No. 484): A plaster form was made of the amputated shoulder. A leather socket was molded over the plaster form and then fitted to the patient. The forearm and arm segments were made about the same size as the natural arm. A ball joint was made in the arm segment to permit rotation of the arm; the movements are passive but as extensive and varied as the

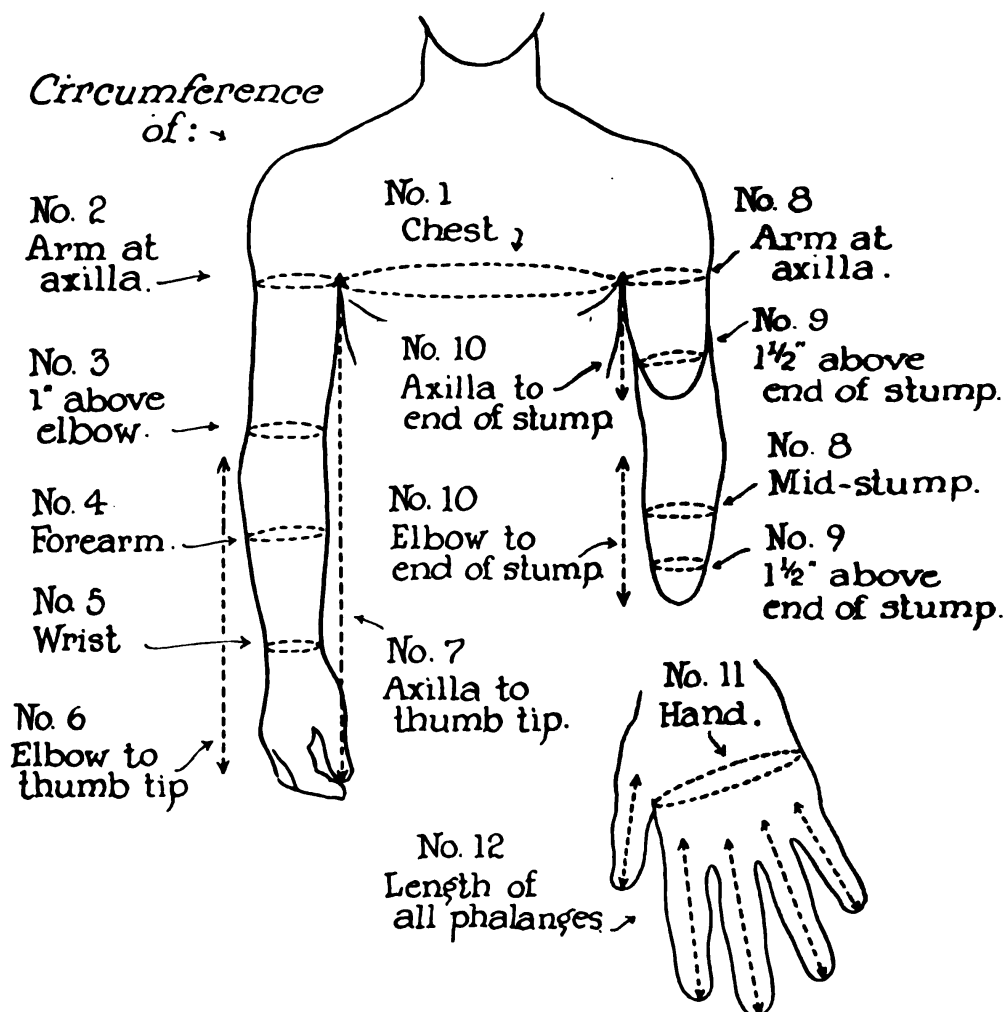


21. Types of prostheses for amputations of the fingers.
a. Three finger amputation: Prosthesis to be worn with glove. **b.** Partial hand amputation, thumb remaining. Two views of prosthesis. **c.** Four finger amputation. Two prostheses: cosmetic and working.

natural arm. Flexion of the forearm is passive and maintained by means of the elbow lock. The control cord from the hand or hook was extended along the lateral side of the arm, passing through a roller on the posterior upper portion of the arm segment and then attached to the shoulder strap. Figure 28 shows a patient wearing the prosthesis.

CARE AND SERVICING OF LIMBS

The artificial limb is a mechanical appliance and its mechanism requires proper care and service. The patients have the opportunity of observing their limbs in various stages of construction, and are instructed in adjustments. Frequent adjustments of the joints and



22. Twelve measurements for arm and forearm prostheses.

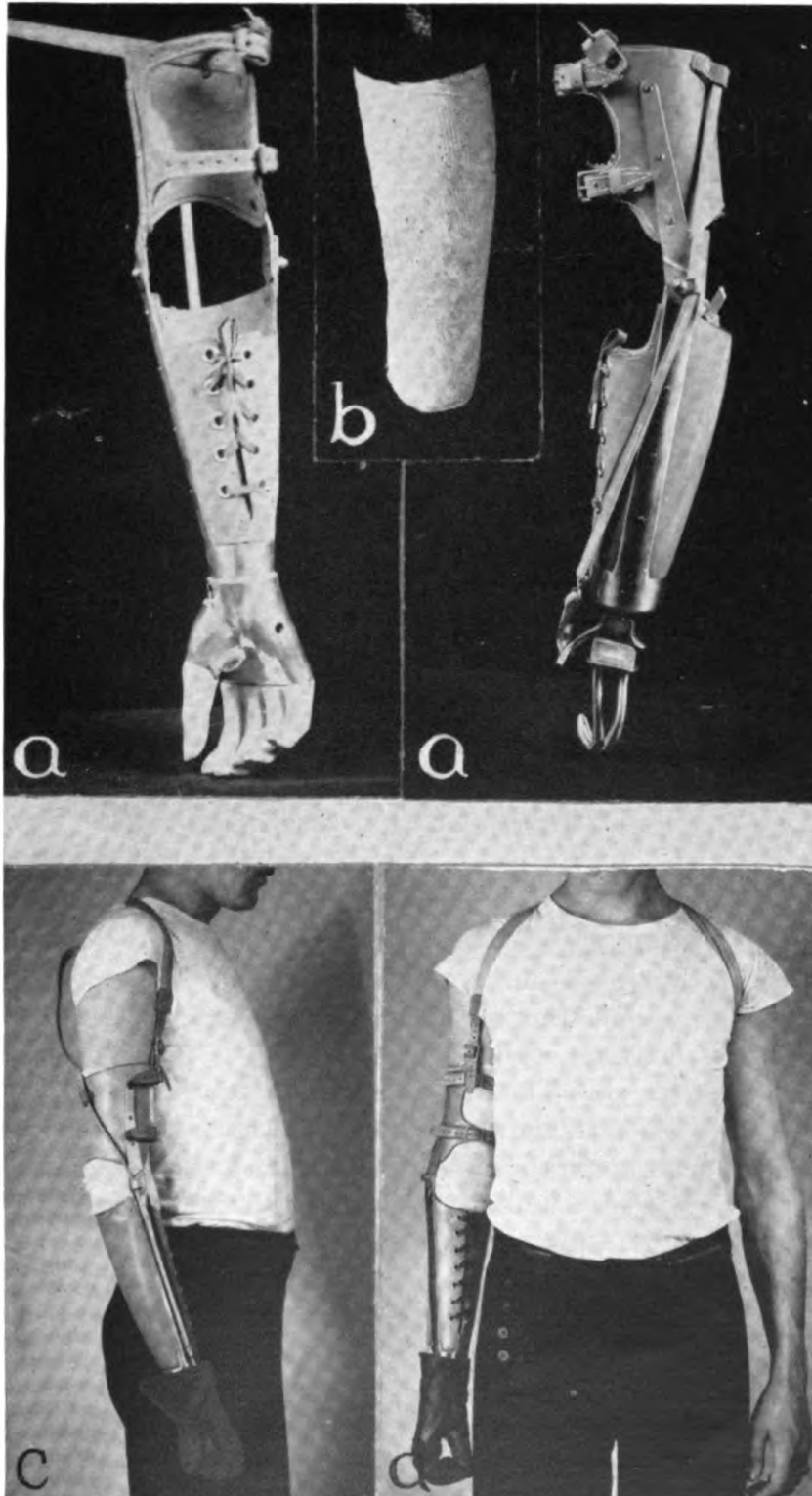
constant care will prolong the lifetime of a limb. Prolonged neglect and carelessness will result in serious and costly repairs.

FUNCTIONAL ASPECT OF ARTIFICIAL LIMBS

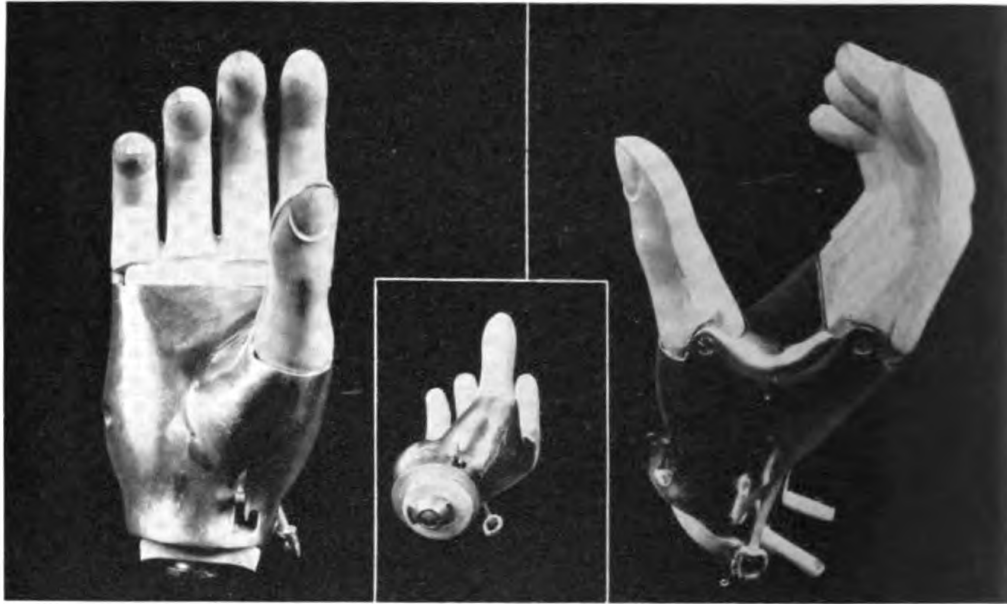
There follows a brief statement of the applicability of prostheses at the various amputation levels.

Partial-foot amputation.—This type of amputation can be fitted with an appliance that is light, strong, not unsightly, and highly efficient.

Syme's amputation.—A Syme's amputation, though providing an adequate and desirable end-bearing stump, has the disadvantages of any low-leg amputation. In general, prostheses for this type of amputation are heavy and bulky because of the bulbous end of the stump. A simple, light and sturdy appliance can be constructed.



23. **a.** Forearm prosthesis with Miracle hand and round-top hook attachments. **b.** Plaster cast of patient's stump. **c.** Side view of patient wearing forearm prosthesis. **d.** Front view of patient wearing forearm prosthesis.



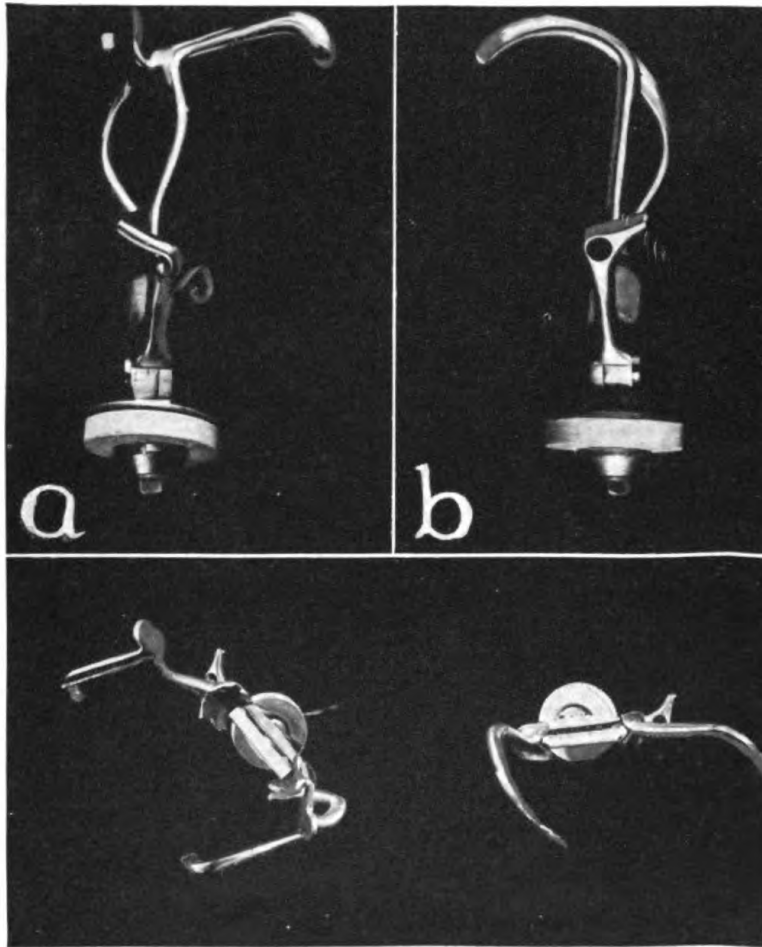
24. Miracle mechanical hand. Note wrist attachment.

however, which permits normal articulation of the ankle at the proper level.

Below-knee amputation.—The amputation of a leg 7 inches below the hamstring insertion results in a stump of very good length. In practice it may be said to be the best, since there is adequate space between the ankle joint position and the stump to fit an artificial ankle joint conveniently. A stump of this length can often-times be fitted with an appliance previously described and known as “mule.” This appliance is corsetless and jointless, the weight being distributed at the level of the tibial condyles.

Thigh amputation.—The site of election for amputation of the thigh is the junction of the lower and middle thirds. This site is determined by orthopedic considerations. First, since muscular action is essential to good locomotion, a thigh amputee with a good length of stump has muscle power to achieve locomotion very similar to normal. Second, sufficient room is left below the stump for the installation of a knee-joint mechanism that combines simplicity with strength.

Disarticulation of hip.—In this type of amputation, the patient has difficulty in swinging a prosthesis because of the lack of muscular power. Movement of the trunk as a whole is the only source of muscular power for activating the artificial limb. It is essential that in a standing position, the line passing through the center of gravity of the body should fall in front of the axes of the ankle and knee joints, so that the limb secures perfect rigidity without the aid of a knee lock.

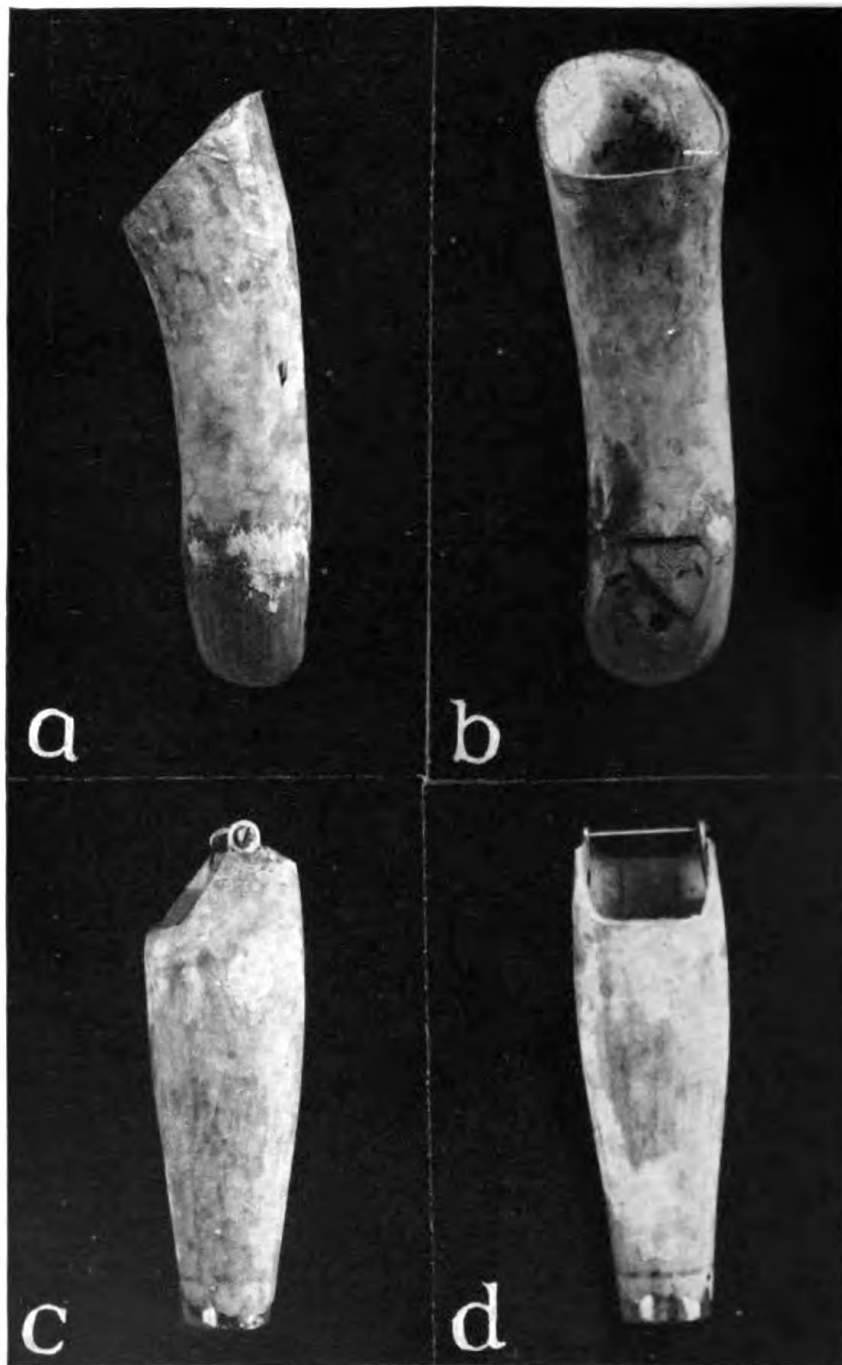


25. **a.** Superfarmer's mechanical hook, closed and in full extension. **b.** Dorrance round-top utility hook, closed and in full extension.

Gritti-Stokes (end-bearing) amputation.—Prostheses for this type of amputation are generally heavier and rather unsightly. There is not sufficient room below the stump for installation of a knee mechanism at the proper knee center. Usually, side knee joints are attached and the limb has no effective friction control. With the use of plastic material and specially designed knee joints, however, it is possible to construct a limb with the desired friction control. This appliance is light, sturdy and does not tend to be unsightly.

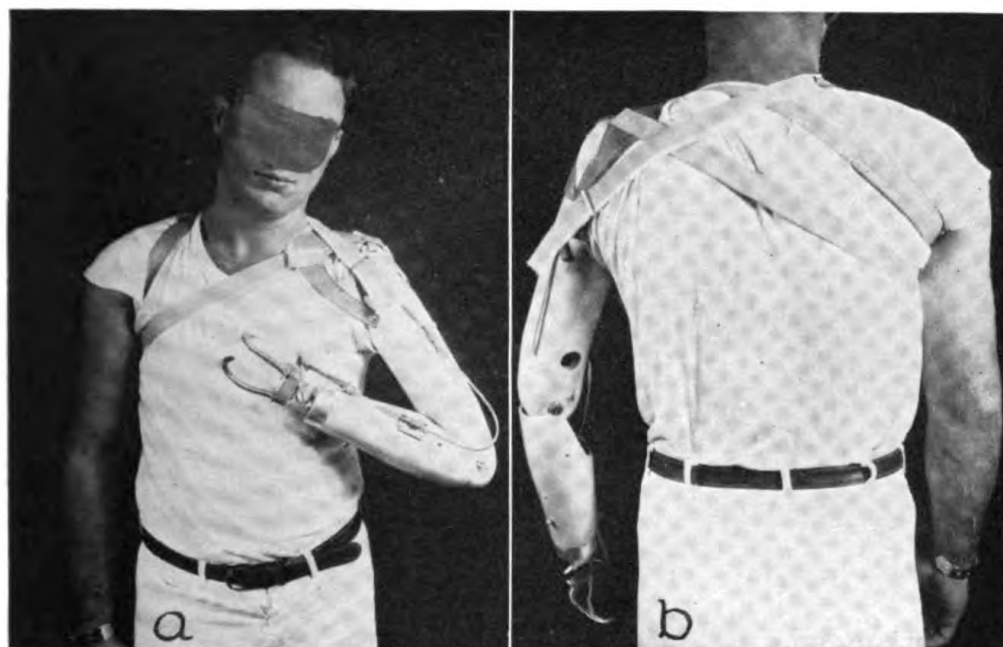
Disarticulation at wrist.—Amputation at the wrist can be turned to good use when fitted with an appliance utilizing pronation and supination to control the artificial hand.

Forearm amputation.—The junction of the lower and middle thirds may be considered the most acceptable length for ordinary forearm prostheses. Amputation lower than 2 inches above the wrist interferes with the fitting of an appliance. Amputation 2 inches below the biceps insertion leaves the shortest acceptable stump.



26. Arm prosthesis in the making: **a.** Anterior view of arm segment. **b.** Medial view of arm segment. **c.** Anterior view of forearm segment. **d.** Medial view of forearm segment.

Arm amputation.—Amputation of the humeral segment made 2 inches above the center of the elbow is considered the longest suitable stump, and 2 inches below the axilla is the shortest suitable stump for fitting with a prosthesis, although a very high amputation of the arm is preferred to disarticulation at the shoulder.



27. Patient wearing arm prosthesis.

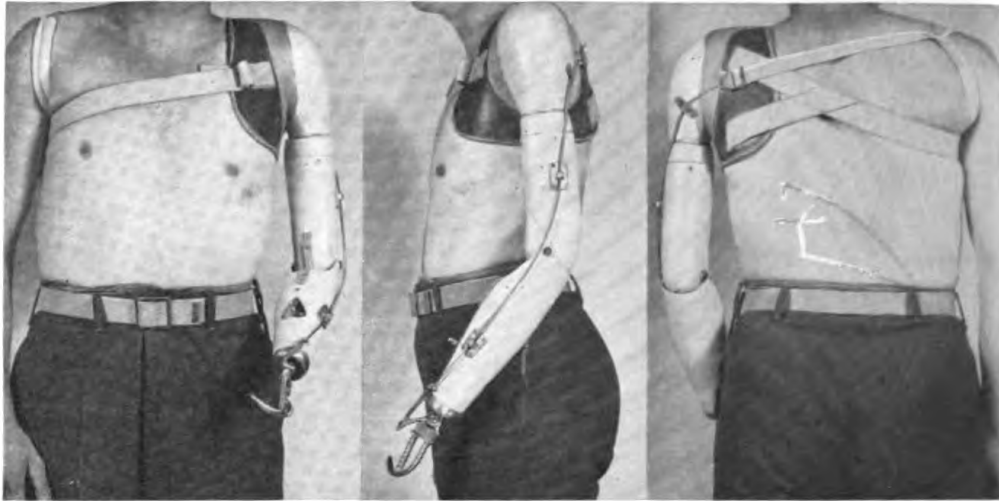
Disarticulation at shoulder.—It is possible to fit an appliance both light and movable, though its functional power is practically nil.

PREDICTABLE RESULTS WITH PROSTHESES

The value of prostheses for the lower limbs is in proportion to the degree of locomotion which they restore to the amputee.

Leg amputations.—The leg amputee with a very short stump who still has power of movement in the knee is in a much better situation than the thigh amputee. The preservation of the knee intact gives these amputees a considerable advantage, since their power of locomotion is almost normal. The amputee with a good-length stump can follow any occupation or activity under normal conditions. Amputee No. 105, an aviation cadet, who was discharged in September 1944, is now a student at a medical school in the middle west. In a recent letter, he stated that he wore his prosthesis from 14 to 16 hours a day. He engaged in various sports activities and was a member of the basketball team.

Thigh amputations.—A thigh amputee can stand and walk quite satisfactorily. The extent of locomotive power depends on the length of the stump. Having been well-fitted and well-trained in the use of his artificial limb, the thigh amputee can carry on a trade or occupation quite normally. The following is an excerpt taken from a letter written by a Naval officer with an amputation of the left thigh. "I am on full shore-duty status, work 6 and sometimes 7 days a week at a fairly responsible position, and am only slightly inconvenienced



28. Prosthesis for disarticulation at shoulder.

in carrying on a routine in no way different from what it would be had I not been wounded. Only my very closest friends and colleagues know I have lost a leg. I drive my 1942 Ford without having had any change or adjustment to the controls. I have never yet had any irritation or soreness except normal muscular fatigue after an active day. I never take the leg off except to go to bed at night."

Disarticulation at hip.—A man who has undergone disarticulation of one hip can recover power of locomotion to an extent quite sufficient to carry on a suitable manual trade, provided his prosthesis is well fitted and constructed. Of our two amputees fitted with such appliances, both achieved exceptional results. They were capable of walking with normal articulation of the knee, and with only a slightly perceptible abnormality of gait.

Bilateral lower-extremity amputations.

Provided the stumps are good, a man with both legs amputated need not be greatly handicapped. It is exceptional for such an amputee to lose his power of locomotion, and his everyday life suffers but little as a result of his disablement.

In comparison with an amputation of both thighs, the combination of thigh and leg amputations is less disabling; such men can recover sufficient power of standing and walking to allow them to lead a regular everyday life.

Though seriously disabled, a man with both thighs amputated can recover sufficient power of locomotion to enable him to engage in some suitable occupation.

Forearm amputation.—The forearm amputee can enter any one of a large number of occupations if he is fitted with a suitable prosthesis.

Amputee No. 214, now managing a farm somewhere in Illinois, finds himself capable of husking as much corn as he ever did, can drive a tractor or a team of horses and can do any amount of plowing without any trouble.

Arm amputation.—An arm amputee, though his efficiency is not to be compared with that of the forearm amputee, has a considerable capacity for work, especially if his occupation is not too specialized. Amputee No. 153 has found himself capable of handling a large tractor, wrangling horses, and roping steers.

Disarticulation at shoulder.—These amputees, though fitted with an appliance that is fairly effective, find their efficiency rather limited. Flexion of the elbow is passive and controlled by the sound hand. The patient is able to control only the articulation of the hand or hook. The capacity for manual work is limited.

PSYCHOLOGIC FACTORS INVOLVED

The functional efficiency of the prostheses described in the foregoing pages depends on many factors inherent not only in the appliances but in their wearers. The nature of the prosthesis obviously influences the results obtained, but the chief factor is the will of the amputee. Some men make remarkably good use of their prostheses even in cases of double lesions. Others, on the contrary, are practically cripples, even though their actual disability is not serious. Amputee No. 70, who had an amputation of the left thigh with a 12½-inch stump, was fitted with an appliance. He was very disappointed with the results, and at the time of his discharge was convinced that he would never be capable of regaining normal efficiency with his limb. Several weeks after discharge he was induced to try a game of golf. Prior to the loss of his limb the patient was a proficient golfer with a score in the low 80s. Now he has not only recovered full and normal efficiency with his limb, but is capable of playing 36 holes of golf with an average score between 80 and 85.

SUMMARY AND CONCLUSIONS

Our experiences in supplying over 500 artificial limbs to amputees under treatment in the Philadelphia Naval Hospital are presented. Under the supervision of the writer, a limb-maker by profession, these prostheses were manufactured by Naval personnel without previous experience in this field but selected because of cognate skills in working with the necessary tools and materials, and who therefore could be instructed in limb-making within a period of 3 months. The reasons for the use of a plastic laminate in the construction of prostheses are set forth. Illustrative case material is presented, with

a discussion of the type of prosthesis applicable and its functional potentialities at the various sites of amputation.

As a result of proper limb-making, combined with optimal surgical and orthopedic treatment, the gravity of amputations of the lower extremity has been greatly reduced. Amputation of the leg, or even both legs, no longer produces an irreparable defect. There is still much room for improvement, however, in the mechanical design of upper limb prostheses. Yet here, too, some recent structural advances and, above all, the will and initiative of the patient in acquiring skill in the use of his prosthesis go far to offset his handicap.

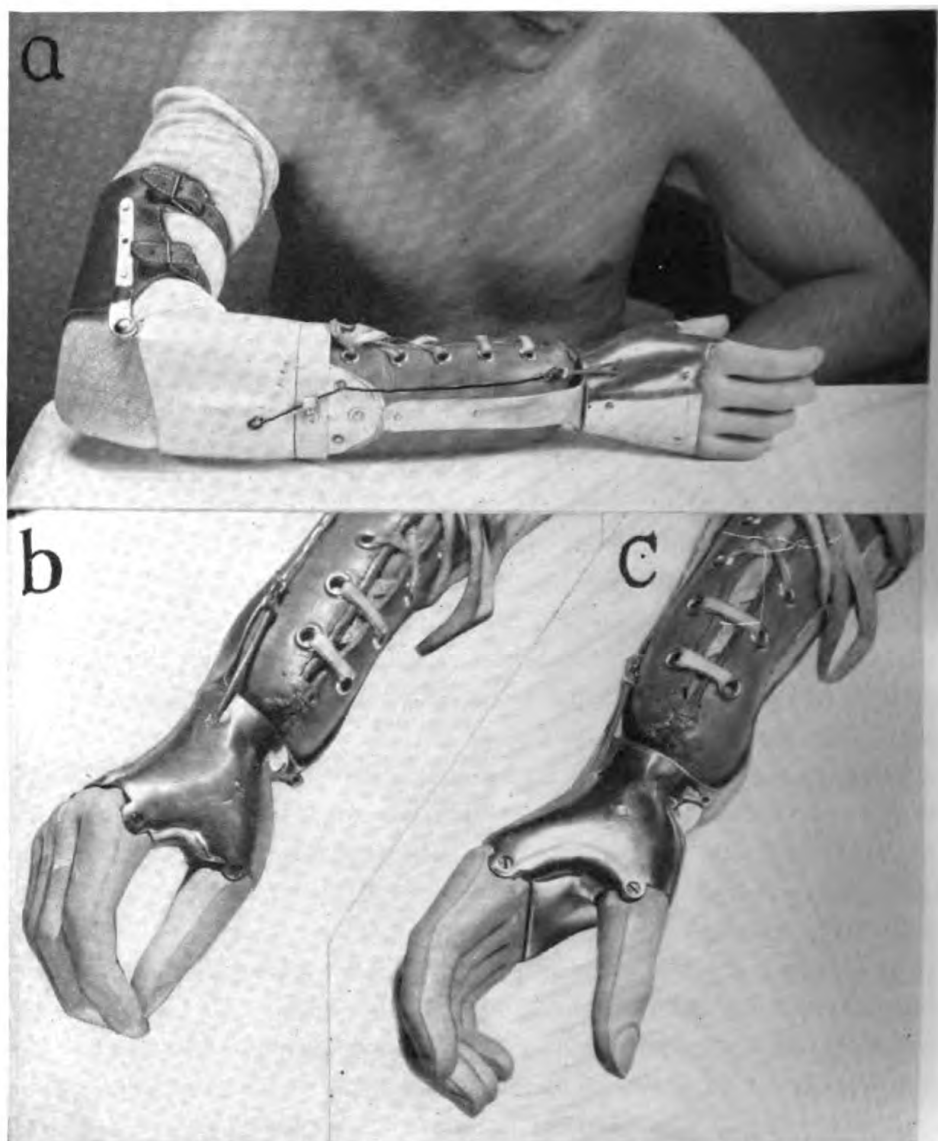
IX. PRONATION AND SUPINATION PROSTHESIS FOR DISARTICULATION ABOUT THE WRIST (ROTA-ARM)

DONALD T. JONES
Commander (MC) U.S.N.R.
and
BASIL PETERS
Lieutenant H(S) U.S.N.R.

The mechanical control of prostheses of the forearm is far from satisfactory to the patient. This inadequate control, combined with the appearance and weight of the appliance, often leads patients to discard these prostheses. A prosthesis has been developed at this amputation center which utilizes rotation of the forearm in controlling the artificial hand, and which we believe represents an improvement over previous appliances.

Opening and closing (extension and flexion) of the artificial hand have heretofore been controlled by forward motion of both shoulders. This does not control the position of the artificial hand or hook with regard to rotation; the latter motion is performed to a limited degree by abduction and adduction of the upper arm. Any further rotation is performed by the opposite hand, and in cases of bilateral arm amputations, by the prosthesis of the opposite side. Complete loss of pronation and supination in an otherwise normal extremity gives a marked degree of disability; such disability is of even greater degree in an amputee. The Northrup Aircraft Company has developed a forearm prosthesis in which the cross-shoulder control of the artificial hand is the same, but rotation of the prosthesis is controlled by utilizing pronation and supination of the forearm stump. Patients who have worn the ordinary prosthesis find that the Northrup device improves function.

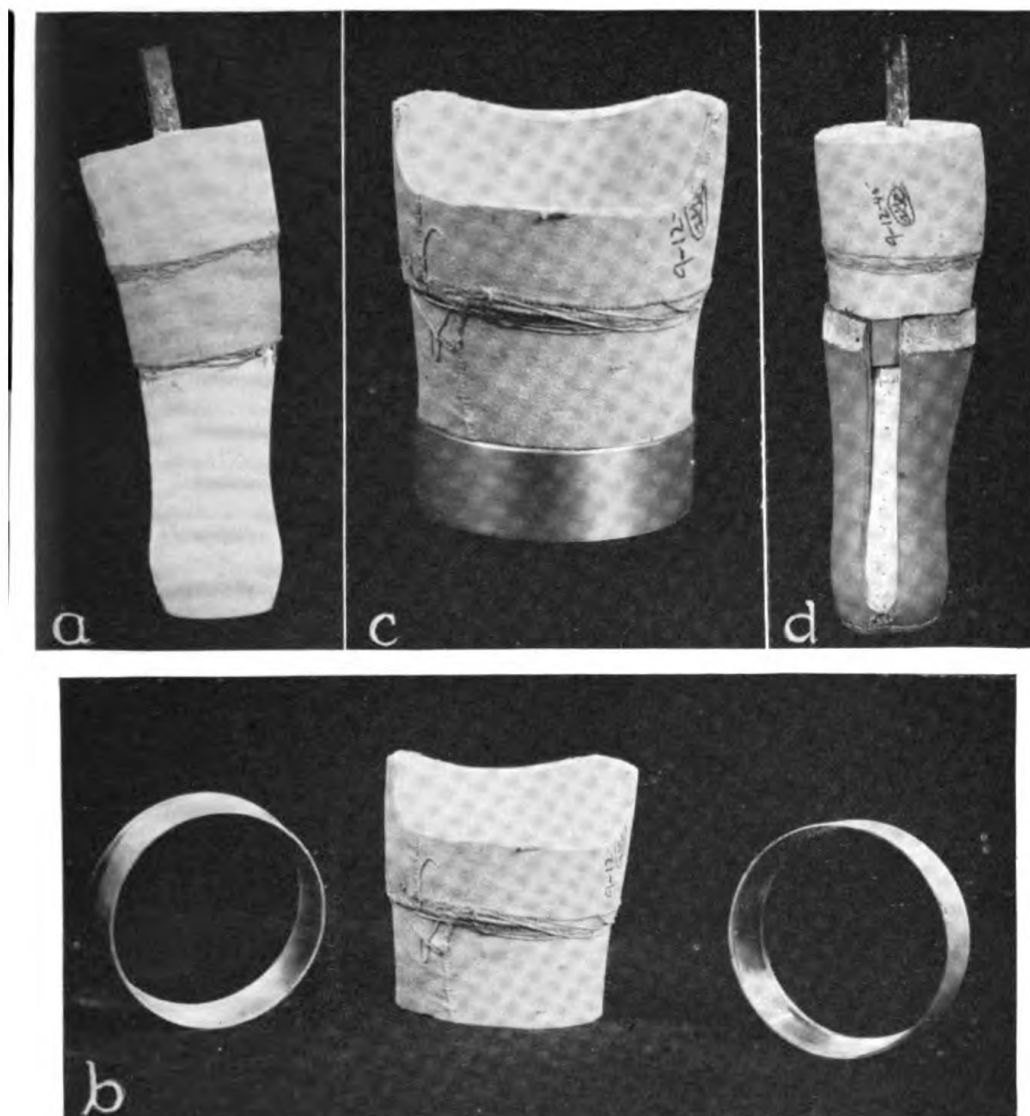
At this amputation center we have developed and used a prosthesis that converts pronation and supination into direct control of the artificial hand. The Miracle hand is used and attached to the prosthesis in such a way that pronation of the forearm closes the hand, and supination, by releasing tension on the automatic spring, opens it (fig. 1). As a result the patient has much greater direct control of his artificial appliance, has good power, and the cross-shoulder suspender is eliminated.



1. **a.** Patient wearing prosthesis. **b.** Supination opens hand. **c.** Pronation closes hand.

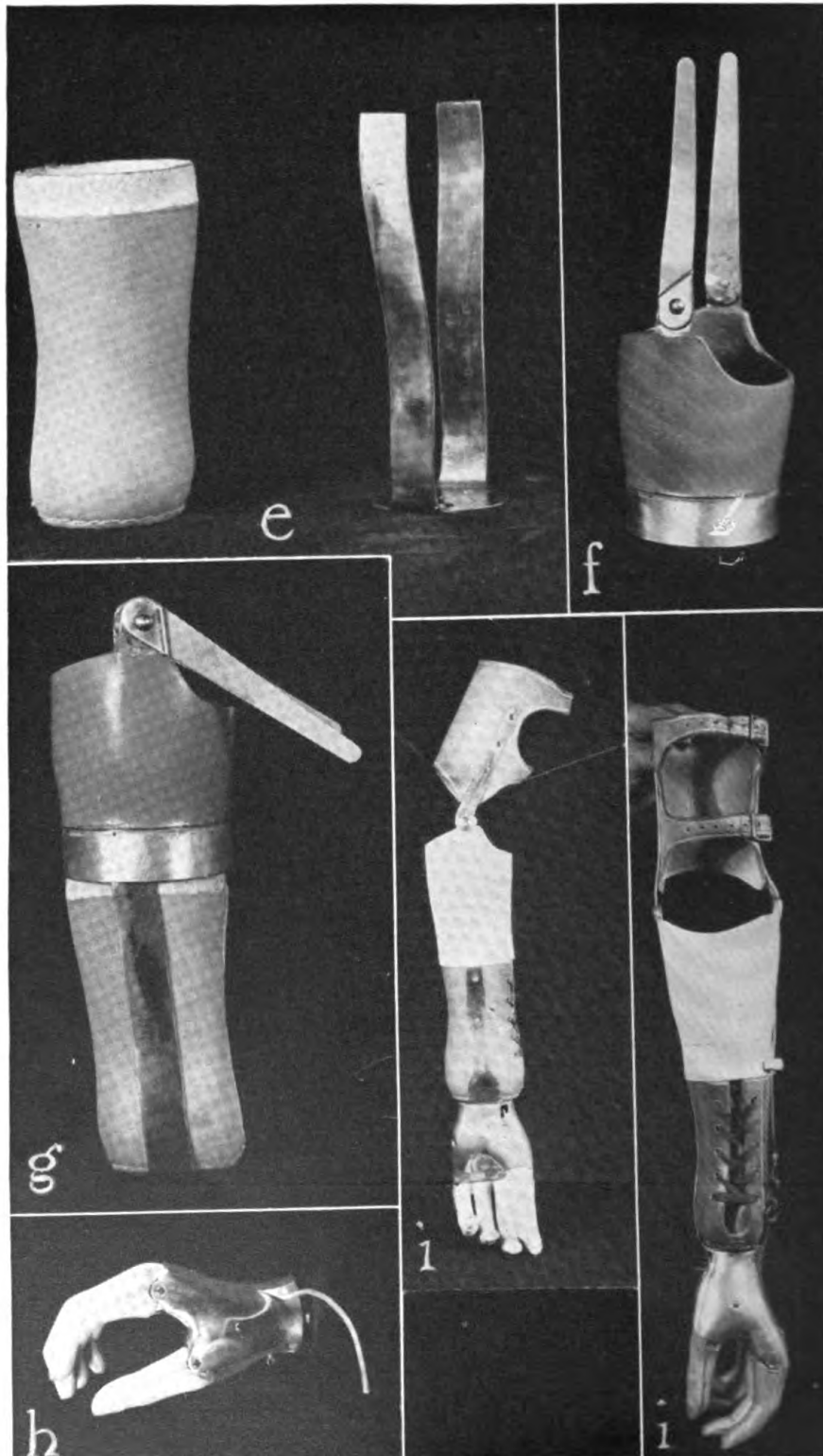
Construction (figs. 2 and 3)

A plaster form is made of the stump as high as the elbow, with that joint at 90 degrees and the stump midway between pronation and supination. A leather socket lined with horsehide is molded around the lower two-thirds of the plaster form and made so that it can be laced up over the volar surface of the stump. This leather socket is the lower movable part of the prosthesis. A plastic socket is laminated around the upper one-third of the plaster form. This plastic socket becomes the upper fixed part of the prosthesis within which the wearer's forearm can rotate in pronation and supination.



2. **a.** Plaster form with laminated plastic socket. **b.** Plastic socket with two interlocking metal collars. **c.** Collars attached to plastic socket. **d.** Plastic socket with leather socket molded on form

The plastic socket is attached by means of side elbow joints to an upper arm corset which holds the plastic socket fixed when the lower leather socket is rotated. The leather socket is joined to the plastic socket by means of two metal rings, the one attached to the lower end of the plastic socket, the other to the upper end of the leather socket. These rings interlock, holding the two sections together, thus permitting the inner ring (lower segment) to rotate freely within the outer ring (upper segment). A U-shaped metal band, its free ends attached to the inner aspect of the metal ring, lends stability to the lower leather socket and, at the bottom of the U, affords the means to attach the Miracle hand to the prosthesis.



3. e. Lower leather socket and metal frame. f. Plastic socket with metal collar and elbow joints attached. g. Assembled forearm segment. h. Miracle hand ready for attachment. i. Finished prosthesis.

The hand-control cord, originating at the upper outer aspect of the upper fixed plastic socket, passes through a small roller guide attached to the rotating collar at the upper end of the lower segment, (fig. 1), then along the forearm and inserts near the "wrist" into the control cord of the Miracle hand. Pronation of the lower segment puts tension on the control cord, causing flexion (apposition) of the fingers and thumb. Supination releases tension on the automatic spring of the mechanical hand, causing extension (separation) of the fingers and thumb.

Unfortunately this prosthesis has been developed only for those patients having disarticulations about the wrist joint. Radiocarpal disarticulation has heretofore not been considered a good level of amputation because of late complications, the most frequent of which are painful subluxation of the distal radio-ulnar joint and trophic disturbances. In the use of our appliance, care must be taken that the pressure of the amputation stump against the prosthesis be not directly over the radial or ulnar styloids, but on the volar and dorsal aspect of the radius.

Possible adaptation of this type of prosthesis for higher levels of forearm amputations has been considered, although not yet tried. For example, one might make use of the Lambert procedure (phalangization) which separates for a distance of a few centimeters the distal ends of ulna and radius by skin. The insertion of these two elements into respective sockets of the forearm prosthesis could make possible the use of our device in amputations some inches above the wrist, if pronation and supination are still preserved.

Five patients have been considered satisfactory for this type of prosthesis. The longest period during which a prosthesis has been in use is 9 months, the shortest 3 weeks. Each patient has expressed satisfaction with the appliance, especially in comparison with the functional performance of other prostheses.

Thus far no notable complications have been encountered in any instance. Two patients developed irritation and tenderness over the radial styloid that were promptly relieved by proper adjustment of pressure to volar and dorsal surfaces. There has been no recurrence after 6 months and 3½ months, respectively. However, these patients must be observed for some years before the possibilities of late complications, especially trophic disturbances, may be fully assessed.

SUMMARY

1. A new prosthesis is described which utilizes pronation and supination of the forearm stump in disarticulations about the wrist joint to give improved functional control of the artificial hand.

2. Five prostheses of this type have been constructed and have been in use for periods ranging from 3 weeks to 9 months.
3. The patients express great satisfaction with this type of control.
4. To date there have been no complications resulting from the use of this device, but observation over a period of years will be needed to evaluate unforeseen late complications.

X. PRODUCTION OF COSMETIC HANDS AND OTHER LATEX PROSTHESES

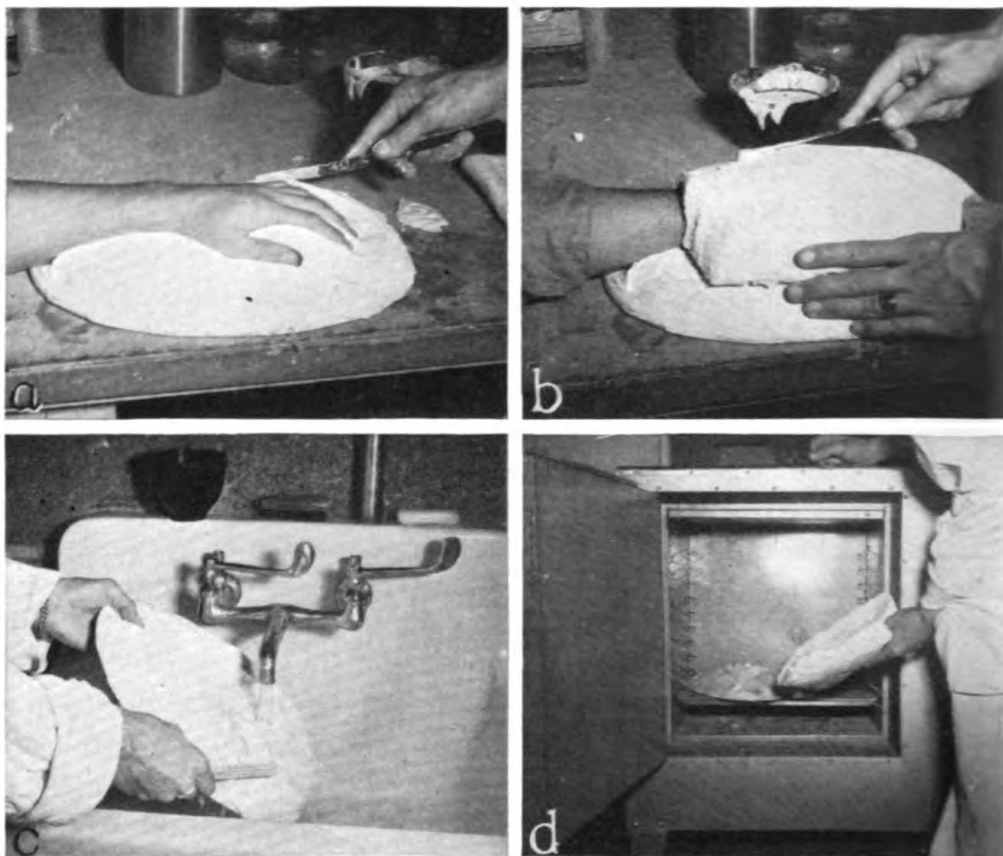
ROLAND D. CUNDIFF

Pharmacist's Mate, third class, U.S.N.R.

The Maxillofacial Prosthetic Laboratory of this hospital was originally established to supply latex reproductions for missing parts of the face. However, the almost total lack of such cases, and the decision of the Bureau of Medicine and Surgery that patients in this amputee center who have lost a hand or part thereof be supplied with a latex prosthesis, combined to make the production of such cosmetic hands the chief activity of this laboratory. One hundred twenty-four such prostheses have been supplied to our patients. The importance of these latex devices in improving the morale of amputees and of the disfigured warrants a report of our experience in, and the technic of, their manufacture.

The primary step in producing any prosthesis is obtaining a plaster working cast of the affected area. The impression may be taken in any one of several suitable impression materials. When this plaster cast has been obtained, it is no longer necessary to inconvenience the patient, unless he has an arm amputation and a cosmetic glove is desired for an artificial arm, in which case a mold is made of his good hand.

The quickest and most efficient mold is made in two pieces. The patient's hand is prepared by shaving, or by application of a heavy lubricant such as petrolatum or cold cream. Shaving is preferable because the skin texture is not thereby covered up. Enough plaster is mixed to make one-half of the mold, and is poured onto a flat, paper-covered surface. With a large metal spatula, the plaster is worked into a mound, shaped to accommodate the hand and wrist. The patient's hand, in a relaxed position, is then pressed into the plaster, palm down (fig. 1a). Care must be taken not to let the tips of the fingers press through; this would weaken the mold, as well as destroy the natural contours of the fingers. The fingers themselves should be far enough apart to allow at least $\frac{1}{4}$ -inch plaster separation, but not enough to result in a distorted appearance. The excess plaster is removed, care being taken to follow the lines of the hand so that the hand is divided into two equal sections. This must be done quickly and deftly, as plaster sets or hardens in approximately 4 minutes.



1. Production of cosmetic hands. **a.** Casting the lower half of the mold. **b.** Casting the upper half of the mold. **c.** Cleansing the mold. **d.** Drying the mold.

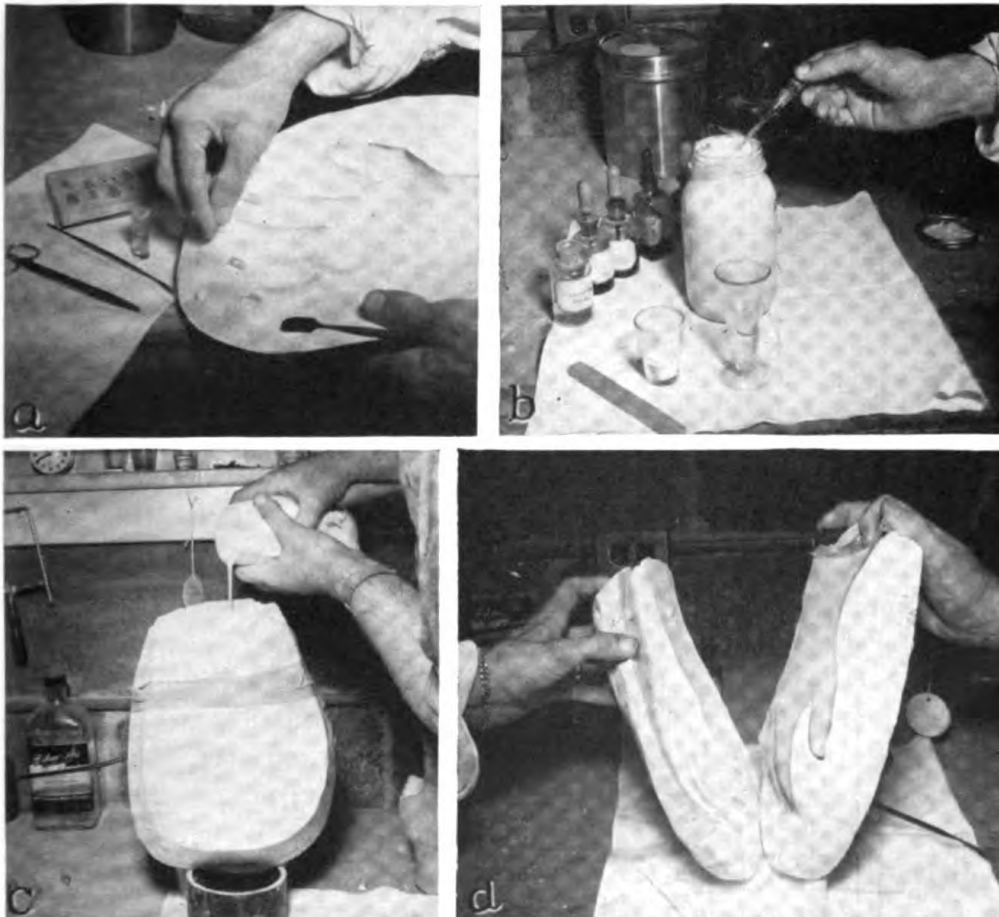
The hand is carefully removed, after which the surface of the mold is smoothed and the edges of the impression trimmed with a sharp knife. Due to a chemical change, plaster becomes warm during the setting. When it starts to cool, the surface is coated with a separating medium up to the edge of the impression. For this purpose, petrolatum, or a mixture of stearic acid and kerosene, may be used.

The hand is replaced in the mold and the upper half is covered with plaster (fig. 1b). When the top has set hard, the two halves may be pried apart with a screw driver. After the hand has been withdrawn, the upper mold is replaced and the whole is allowed to set for several hours to prevent warping. All oil or grease is removed by pouring hot water over the mold, or soaking in a deep sink (fig. 1c). The mold must then be thoroughly dried. If a drying oven is used, rapid heating or cooling must be avoided to prevent cracking (fig. 1d). The dried mold is placed on file for future use.

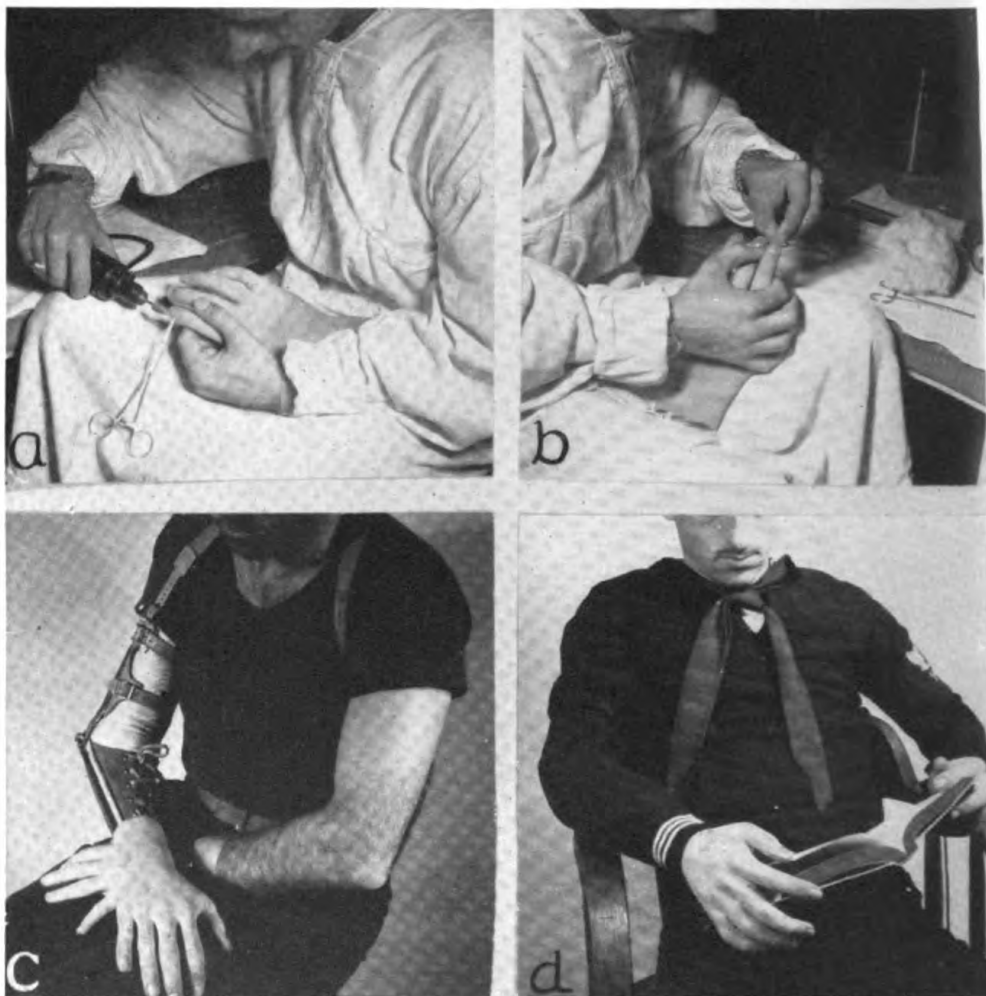
From the file of molds, one is selected that reasonably matches the patient's natural hand in size and configuration. Artificial finger nails are glued into the mold, and the two halves are taped or wired together (fig. 2a). The latex rubber compound is then prepared for

coloring by adding a solution in the ratio of 9 gm. of zinc oxide dissolved in ammonia water to 1 quart of rubber. Aniline dyes, mixed with 28-percent ammonia water, are added until the desired color is produced (fig. 2b). It must be remembered that upon oxidation, the rubber will become darker. An easy way of running a color test is to place a small patch of colored rubber on dry plaster and cure it in a drying oven. When satisfied with the color, the technician strains the rubber through gauze into another jar to eliminate any solids.

The rubber is poured slowly into the mold until it is filled, and it is allowed to stand for 1½ hours (fig. 2c). The rubber is then poured out and the mold is replaced in an upright position to dry for 24 hours, after which the rubber hand is removed from the mold and the excess trimmed (figs. 2d, 3a). One-eighth-inch string solder is cut into lengths to correspond with the fingers and covered with adhesive. These covered wires are pushed into the fingers, which have been filled with a mixture of rubber and crude cotton, and the



2. Production of cosmetic hand. **a.** The preparatory step in creating nail-sockets. **b.** Preparing and coloring the moulage. **c.** Pouring the mold. **d.** Removing the rough hand from the mold.



3. Production of cosmetic hand. **a.** Trimming seams and nail sockets. **b.** Insertion of nails into sockets. **c.** Attachment of the cosmetic hand to the arm prosthesis. **d.** The completed cosmetic hand.

prosthesis is placed in the drying oven set at 75° C. for approximately 4 hours.

When properly cured, the hand is ready to be "nailed." The artificial nails, made from a cellulose acetate material, may be made in the laboratory or purchased. These nails are trimmed and placed in the sockets created by the nails that were glued on the mold before pouring (fig. 3b). The nails may be made fast by using rubber cement or the glue provided in the commercial package of nails.

Finally, the knuckles and other highlights are tinted with aniline dyes in ammonia water, and dry powdered talc is dusted on the hand to tone down or blend the color. The inside of the hand is stuffed with crude cotton and it is ready to slip on the patient's stump or over the end of his artificial arm (figs. 3c, 3d).

In most cases, a partial hand prosthesis may be made by cutting away the unnecessary parts from a complete hand. Otherwise the missing parts are sculptured in clay onto the plaster working cast of the mutilated member. A mold is made of the sculpture, and the procedure described above is followed.

With a few variations, the procedure for making nose, face, and ear replacements is the same as that used for hands. The differences lie in the preparation of the molds. Aided by photographs of the patient before injury, the technician prepares a clay model of the missing part. This model serves for the preparation of the plaster mold. In eye prostheses eyelashes and eyebrows are inserted into the latex before curing.

To the present 126 latex prostheses have been made here, including 124 cosmetic hands, of which 21 were partial and 103 were complete (72 right and 31 left hands). One patient was provided with a latex replacement for each ear.

The goal of the laboratory has been to produce a hand of positive esthetic value, which will aid the psycho-social rehabilitation of the patient. Many difficulties, at present not yet overcome, prevent the mechanization of the cosmetic hand, and as yet its therapeutic value is wholly psychologic. Other departments of this hospital have provided the amputee with devices for practical, workday use, and under most circumstances, at home and among close associates, the amputee may adjust to his loss fairly readily. In public, however, among casual acquaintances and strangers, he may become the resentful object of curiosity; even a glove worn over a mechanical appliance indicates the loss of a hand. Accordingly, our goal is to supply a hand which at a glance seems exactly like his natural hand. With such a cosmetic aid, the amputee draws no attention from the transient observer, and feels free to go about in public.

The success of such a laboratory depends upon the ability and resourcefulness of its technicians, who should possess artistic backgrounds and interests. Each case presents its own problems, to the solution of which the technician must bring a sense of esthetic values and a highly personalized service; cosmetic prostheses cannot be made by production-line methods.

XI. PHYSICAL REHABILITATION OF THE AMPUTEE

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Lieutenant H(W) U.S.N.R.

This report includes the work done by the sections for physical therapy, occupational therapy, and physical education of the department of physical medicine in the physical rehabilitation of the amputee at this center.

At the outset the magnitude of the problem seemed out of proportion to the facilities at hand with which to solve it. But with the passage of time, it began to appear that the size of the group offered certain invaluable advantages. These will be discussed.

For such a program to accomplish its mission, there must be harmony of effort between the orthopedic, physical medicine, and prosthetic shop staffs. This we had. Our work was largely under the direction of the orthopedic staff.

PHYSICAL THERAPY

From the beginning, the orthopedic staff held the opinion that the routine use of heat or massage, or both, in the management of the uncomplicated prerevision, postrevision, preprosthetic or postprosthetic stump was of no value. With this viewpoint the department of physical therapy was in complete accord. Consequently, procedures were limited to the treatment of complications. The patient was referred to the department by the orthopedist, and was accompanied by a routine form on which were recorded the diagnosis, the specific condition for which treatment was desired, and often the therapy desired.

The most common complication encountered was chronic inflammation about the stump, frequently with associated circulatory deficiencies. The usual chronic inflammatory symptoms and signs, namely, pain, tenderness, swelling, and atrophy of contiguous mus-

culature, with its sequelae of disuse, were often present. Consequently, the most frequently requested form of treatment was the whirlpool bath.

The technic consisted of immersing the part in the whirlpool for 20 minutes at 105° Fahrenheit. Two treatments were given daily, morning and afternoon. Daily notations were made on the progress card by the technician. It was interesting to observe these entries. With amazing regularity, there appeared after treatments such remarks as: "Marked improvement;" "better motion in proximal joints;" "stiffness less." Favorable comments of the patients usually paralleled the technician's entries. It was encouraging to observe chronically inflamed, often suppurating tissues promptly exhibit unmistakable evidence of improved health.

Always accompanying these inflammatory lesions was striking muscular atrophy of disuse. As healing took place, appropriate massage and exercises were given. Advantage was taken of the opportunity to instruct the patient concerning the imperative need of developing not only the local musculature of the stump, but that of the body as well. The orthopedists have been unanimous as to the therapeutic value of the whirlpool bath in the management of this problem.

The next most frequent complication encountered was contracture of muscles and tendons, particularly in below-knee amputations. Loss of the leg upsets the balance of muscle power between the hamstrings and quadriceps muscles, with the hamstring usually predominating. Not infrequently there was associated intrinsic and extrinsic joint disease, such as traumatic arthritis and periarticular fibrositis, the latter being characterized by joint stiffness, often of crippling degree.

Heat, massage, and exercises applied daily, preferably by the same technician, were the most satisfactory treatment. The same applied to the problem of scar tissues. With application of these procedures often, and over sufficiently long periods of time, it was remarkable to see how much scar tissue deformity could be overcome. Some problems naturally arose from injuries to the other extremities, but these were individualized and treated in accordance with presenting indications. Chief among these were fractures, and muscle deformities arising from disuse.

As is so often the case, the most difficult problems were in the inept individuals and in those on whom the logic of persistence in effort seemed never to be impressed. In those patients, the simplest of complications became major ones. Fortunately, however, these patients were few in number.

Finally, it may be said that emphasis should be placed on the frequency of treatments, daily when practicable, by the same technician,

over sufficiently long periods of time to accomplish maximum recovery of function.

PHYSICAL EDUCATION

Prior to the designation of this hospital as an amputee center, the Bureau of Naval Personnel and the Bureau of Medicine and Surgery had established the physical training program, so that both officer and enlisted personnel especially trained in physical education were available.

The program here was divided into three general categories.

1. Physical reconditioning or preprosthetic training: If the amputee is to walk again and to achieve maximum usefulness to himself and to society, he must depend upon the aid of a prosthesis. The maximum usefulness of these appliances can only be attained if the local and general muscular powers are adequately developed. Full measure of this will depend upon certain, now known, chemical and physiologic contingencies.

For many years it has been known that when previously active people suddenly have to become sedentary by disease or injury, not only psychologic but physical and chemical deterioration sets in. It has been only comparatively recently that the actual chemical changes have been known. Within the past year, Keys at the University of Minnesota has called attention to a few of the specific changes which occur when the normal uninjured and unsick individual is put to bed. Working with conscientious objectors, he found after 6 weeks of bed rest that: (a) Blood volume was reduced 10 to 20 percent; (b) calcium balance was upset; (c) more than twice the usual amount of protein in the diet was necessary to maintain nitrogen balance; and (d) there was marked increase in urinary output of thiamine and riboflavin.

Furthermore, in an excellent report on the management of spinal injuries at the National Naval Medical Center, Bethesda, Md., Sheldon and his coworkers stated in the discussion of the spinal paralytic that: "It was observed that excessive excretion of lime salts due to physical inactivity with resulting demineralization of the bones, can best be corrected by attention to exercising the non-paralyzed muscles and bony structures of the upper half of the body . . . Most striking of all is the effect of exercise on calcium metabolism, the bones become normal, hypercalcinuria ceases." These observations are exceedingly important and are equally applicable to the amputee.

Following admission, the patients were therefore started on daily calisthenics by a qualified athletic specialist assigned to the ward. In addition, special exercises were prescribed to develop strong arm, shoulder, and abdominal muscles.

2. Exercises for special muscle groups, particularly those muscles moving the stump, were carried out by the athletic specialist on the ward, in physiotherapy, and at the gait-training classes. The amputee was trained to realize that to compensate for his loss he must have stronger arm, shoulder, and abdominal muscles. In case of the lower-extremity amputee, the other extremity has to take over the extra work load and the muscles have accordingly to be developed. Frequently the leg or thigh amputee complained of fatigue and pain in the arch of the normal foot; therefore foot exercises were stressed.

Strength and normal range of motion of the stump were very important in the preprosthetic stage. All below-knee amputees showed definite weakness of the knee joint and this had to be strengthened by active and resistive exercises. Flexion deformities of the knee joint were frequently encountered and were corrected by daily resistive exercises. A flexed knee joint will not allow the weight to be carried on the prosthesis properly, resulting in pressure on and soreness of the knee.

Thigh amputees frequently showed flexion and abduction of the stumps. Abduction caused lateral swing of the prosthesis and handicapped the patient's attempt to ride directly over the limb. Lack of normal extension limited the stride and caused pelvic tilt. In addition, while the patients with complications were receiving physiotherapy, attention was given to these special problems so that when the day came for prosthesis and gait-training, the conditions described would have been met.

Organized and properly supervised sports, such as swimming, bowling, soft ball, shuffleboard, croquet, basketball, and golf were of great help in the development of special muscle groups and particularly in giving strength to the normal extremity.

3. Gait-training: The imperative need for instruction in the proper use of prostheses was recognized early in the program. A plan was devised whereby classes in gait-training were set up, with an officer in charge assisted by two specially qualified physiotherapy technicians. There were morning and afternoon classes.

Upon receipt of the properly fitted prosthesis, the patient was immediately assigned to one of these classes. There he was taught the fundamentals of what constituted good walking habits. Such pitfalls as over-anxiety resulting in irritation of the stump and acquisition of poor postural habits were largely avoided. Here, again, the opportunity was afforded to overcome such muscular defects as might have been overlooked, and corrective measures were instituted. But the outstanding value of the gait-training classes was the contagious influence which the good student exhibited over the one with limited aptitude. Some veritably took up their prostheses and walked off with

them. This exhibition of adaptability saved many tedious hours of instruction which otherwise would have been necessary for those less fortunate in acquiring the skill of walking.

Space for the classes was set aside and the usual appurtenances provided. The beginner was encouraged to use a cane for support for walking any distance. Using a hand railing for support, simple balancing exercises were taught with proper weight-shifting over the prosthesis. This was followed by other weight-shifting movements without support, which added to confidence in the use of the prosthesis. The patients were taught to keep their eyes off the floor, to take equal-length strides, and to shift the weight entirely over the prosthesis with each stride.

The thigh amputees required more fundamental practice before they were able to trust the prosthesis without a knee. Walking by holding onto a railing, sidestepping, and additional balancing activities with support soon gave them the necessary confidence to try walking without a cane. Such obstacles as knee-shooting, backsagging, shoulder-dropping, pelvis-tilting, and walking around the prosthesis were readily corrected.

Single-lower-extremity amputees with an associated injury of the other extremity of course required longer periods of instruction. For such patients the prosthetic leg often was at first the more reliable, but after complete recovery from the associated injury, they became satisfactory walkers.

Bilateral below-knee amputees were taught to walk on crutches with one prosthesis in order to have the feeling of security on at least one extremity. When the other prosthesis was added, the patient first walked in a mobile walker, then successively by means of parallel bars, crutches, two canes, one cane, and finally with no support. In like manner, walking was accomplished by the thigh and below-knee amputee.

Bilateral thigh amputees were started on short pylons without knees, using two short canes for balancing purposes. With normal length legs it was not necessary to lock either knee if the patient had learned the four-count rhythm on crutches. Even in this group, it was surprising how much restoration of locomotion could be had in the individual who was willing to put forth the effort.

One hundred seventy-five patients have completed the gait-training program and are considered to have received maximum service from their prostheses.

OCCUPATIONAL THERAPY

The psychologic, sociologic, and economic imbalance of the amputees was foremost in mind when this program was made up. These

patients lived together under the same roof and each learned from the other.

The work for each amputee was selected with the objective of aiding in the preparation of the muscles of the stump and adjacent structures for the event of prosthesis and to prepare the amputee for vocational rehabilitation. Following the fulfillment of these two precepts, the amputee was permitted and encouraged to avail himself of other useful and diversional facilities.

Correlated with prevocational activities was the selection of the prosthesis most applicable to the individual's needs and the supervised practice to gain skill and competence in its manipulation.

The activities for the upper-extremity amputees were governed by the site of the amputation and the involvement of either the dominant or the nondominant arm. The dominant-arm amputee must be retrained for opposite handedness. This training was initiated while the patient was still in bed awaiting surgery and was continued after the operation. Writing skills were of particular importance during this period. Mastery of writing allowed the patient to carry on his own correspondence and gave him a sense of independence. It was found that the use of writing clip boards facilitated the art of writing as it prevented the paper from slipping. Lined paper to begin with helped the patient get the feel of writing evenly. The acquisition of the prosthesis gave the patient the choice of using either hand for writing and other activities. Leatherwork and carving were found to be good projects to increase finger dexterity and coordination and also to stimulate good mental outlook as to the possible use of the remaining hand.

When the patient became ambulatory, he went to the shop and engaged in more strenuous and more intricate activities such as radio assembly, woodwork, printing, fly tying, typing, and plexiglass work. These activities enabled the patient to attain skill in the task involved, to attain coordination and smoothness in the operation of the prosthesis, and actually to try out under working conditions the particular style of appliance which was most adaptable to the work he had chosen.

All upper-extremity amputees were given the Achievement test to determine whether they were ready for discharge. This test contained 38 items which the patient was required to perform satisfactorily before a passing mark was given. These included such acts as: Dressing skills—fasten shoes, knot tie, adjust belt; eating skills—use knife and fork, pick up glass and cup, dial telephone and take down message, wrap a package, open door with Yale lock, cut a board in a miter box, use a handsaw, drive a nail, and turn a screw. These activities need coordination of normal hand and prosthesis and

require the use of both. To date 29 upper-extremity amputees have successfully passed the test. Stress was placed on using the prosthesis as a helping hand in the case of one-arm amputees. Bilateral activities and those involving reciprocal motions were encouraged. Success was frequently determined only by the amount of will and determination the patient had to overcome his handicap.

The lower-extremity amputee, while confined to bed, was given therapeutic diversional occupational therapy. This consisted of general crafts, typing, or any other activity which stimulated the patient mentally and helped him adjust to his handicap. When fitted with his prosthesis, occupations involving bicycle sawing, treadle sanding, and flying the Link trainer were prescribed for the patient. These activities were instrumental in increasing circulation, toughening the muscles of the stump, and strengthening the muscle groups of the related parts.

The occupational therapy program for amputees was coordinated with the physical therapy, physical education, educational, and recreational programs.

SUMMARY

For those whose job it will be to participate in the physical medicine of amputee rehabilitation in the postwar period, we have presented our experiences with this large group.

CONCLUSIONS

1. Paradoxically, the large number of amputees was a major advantage in the physical medicine program.
2. Except under special circumstances, heat and massage were not used on stumps, either before or after prosthesis.
3. The whirlpool bath was considered to be of great value in the management of chronic inflammatory and circulatory deficiency conditions of the stump.
4. Physical exercises, special exercises, and gait-training were considered to be invaluable.
5. Occupational therapy contributed much to the program, especially to the training of the upper-extremity amputees.

XII. EMOTIONAL REACTIONS AND ADJUSTMENT OF AMPUTEES TO THEIR INJURY

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and

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An unselected group of 350 of the 769 amputee patients admitted to this hospital representing all types of amputations and including men of all rates and ranks, were followed from a psychiatric viewpoint to determine their emotional reactions to their injuries and the factors entering into their psychologic adjustment to amputation.

In general, these patients were mature in years; 71 percent were over 21 years of age. Educationally they were a superior group in that 83 percent of them had had more than 10 years of schooling; 38 percent were high school graduates. There was one illiterate in the group, but none was mentally deficient.

In the entire group of amputee patients, there were no noneffective individuals. This group was likewise free of men with neurasthenic, psychasthenic, or hysterical reactions. At least 11 of the amputees passed through mild reactive depressions after admission here. Two of these were double amputees (battle casualties), one of whom was partially blind, while another was a triple amputee resulting from a liberty accident. Twelve amputees displayed transient anxiety reactions during their hospitalization which responded to encouragement and reassurance. One amputee patient found his escape in the excessive use of alcohol.

There were no psychotic amputees. As a group, amputee patients were remarkable for their emotional stability and their objective realism. In explanation of the absence of severe psychoneurotic or psychotic reactions among these patients, it should be remembered that these men are a selected group from the general population from which unstable personalities had been eliminated by psychiatric examinations at induction centers and recruit training camps. A second explanation is psychologic. Amputee patients knew from the moment of their injury that an irrevocable decision had been made. There was no possibility of further combat. They had suffered a definite tangible injury, which was visible proof of the fact that they had done their duty and their injury carried with it an honorable sense of security and protection from the further hazards of war.

Of the 350 patients studied, 308 were normal extroverts in their basic personality reactions. They were friendly, loyal, and cooperative. Thirty-seven patients were considered as quiet extroverts, with similar personality attributes as the extroverts, but more inhibited in their expression. Only 3 patients were found to be seclusive, withdrawn and unfriendly. Traits of impulsiveness, lack of social consciousness, and inability to profit from experience, such as seen in constitutional psychopathic inferiors, were seen in 2 patients.

Eighty-three percent of amputees examined adjusted easily to hospital routine and regulations, while 17 percent displayed periodic hostility and aggressiveness during their hospitalization. These reactions were reflections of basic personality trends and were related to transient anxiety drives precipitated by the forced inactivity of prolonged hospitalization. These patients displayed their irritability by being critical of their medical care, of the nurses, corpsmen, of their food, and of liberty. They repeatedly infringed ward rules. The disciplinary problems arising among the amputee patients were centered in this small group of men.

The morale factor among the amputees was unusually high, particularly so if their injury had been received in battle. The reactions of battle casualties to their injuries were remarkably similar. On returning to a mainland hospital, they effectively suppressed their anxiety over the future and overcompensated by being overly active, alert, cheerful, and optimistic. They lived entirely in the present and anticipated a quick recovery and return home. They were interested in recreation, freedom, pleasures, and entertainment. All were glad to have survived their injury and were grateful at being alive. When questioned, they regarded their injuries as though they were of minor or secondary importance, compared to the fact that they had survived the war. Free from inner conflict of a psychoneurotic nature, and faced with the irrevocable, unchangeable fact of the loss of an arm or leg, they accepted their injuries with utmost realism. The realistic acceptance by the amputee of battle injury is illustrated in the following cases.

CASE REPORTS

Case 1.—A signalman, third class, with both legs missing at midthigh level, said: "Sure; I felt badly when I realized what happened to me, but not for long. Everyone else was killed when we hit that mine on the beach. Whenever I started to wonder about myself, I just thought of what happened to the others. I am lucky to be alive. Then I always knew that my family would want me back, if no one else did. My girl wanted me, also. We're going to be married. I am studying for a Civil Service job. I used to be embarrassed

about going on liberty. People would stare at me sitting in my folding chair. I was shy at first, but now I have grown accustomed to it and don't mind it. The last thing I want is sympathy. I want to work and get married."

Case 2.—A Marine corporal, with his left leg and three fingers of his right hand missing, as well as being almost totally blind, said, "It all happened when I stepped on a land mine. I was lucky not to have been killed. It could have been much worse. You know, I can tell day from night and make out forms and objects. That's a great help in getting around. Look at my hand. In the beginning I couldn't use it. Now I can use the thumb and little finger. I had to keep working on them. The other fingers were blown off. These exercises have made it a good hand again. It wasn't hard to learn to use my leg. I can walk around swell. I have learned to type and to read Braille. I am also studying English and public speaking. I would like to enter politics. I want to make something of myself. I am coming along fine."

Case 3.—A Marine sergeant, with amputation of the left leg, said: "It was on Iwo Jima this happened to me. One of my boys was lying in a shell hole in front of us. He had been hit and was out there crying. He was a new replacement. The Japs kept dropping mortars on him. The men said they would be killed if they tried to get him. He was out there and I couldn't stand his crying. I said, 'I'm going for him. If one of us was out there, we would want someone to come for us.' One of my men said he would come with me. We crawled up to the shell hole where he was lying. The Japs could see us. They were up on a hill. We picked him up. He was badly hit. We climbed out of the shell hole with him when another mortar hit us. It killed him and the boy who came with me. It got my leg but I crawled as best I could and kept covered. It took me until that night to get back to our lines. I have no regrets. I am glad I was a Marine. I feel better having been there than I would had I stayed home. This leg isn't going to interfere with my earning a living. I'd do the same thing over again."

There are several reasons to explain the reactions of these men. First of all, there is the fact that amputees retain their normal personality reactions. They are free of guilt, they are supported by a knowledge that they have fulfilled their duties, and they have a sense of pride in having proved their courage. They have a strong measure of loyalty and courage in their make-up which has been increased by their war injury. By nature, they are decisive, well disciplined emotionally, and trained to accept things as they are. Doubt and indecision were not part of their lives before or after they became battle casualties. They are mature and dislike the helplessness that is implied by untoward attention and sympathy.

Another phase of reaction that all these amputee patients passed through was in the development of unusually strong personal likes and dislikes. However, as a rule, they were loyal to their doctors. It was of interest to note that only 2 patients of the 350 believed that more could have been done for them. In each of these instances, this doubt existed because of the failure of the doctors in the forward areas to explain the reason for amputation to the patient. One of

these patients asked, "Doctor, why did they take my leg off, the bone wasn't even broken? I never could understand it; besides they cut it off way below where I was hit. They didn't touch me until after my leg turned bad (gangrene). The next thing they did was operate." This patient's critical attitude subsided after it had been explained to him that his amputation resulted because his femoral artery had been cut. Another patient said, "They just kept looking at me for 6 days. Then they said 'gas gangrene,' and took my leg off. Why didn't they fix it up the first day?" Simple explanation likewise satisfied this patient as to the surgical necessity for his amputation.

Amputees resulting from accidental injury or medical causes, such as sarcoma and Buerger's disease, were more inclined to be bitter, recriminatory, and insecure in their emotional reactions. Their morale factor was lower and they were more inclined to be uncertain and concerned about the future.

As a group, the amputees at this hospital were too preoccupied with feelings of personal interest and with their surgical progress to evidence great interest in educational facilities. One stated: "Why should I try to jam my head full of stuff when it is full of worries over what I am going to do?" Another said: "My main worry is what I am going to do. It is hard to study when you are upset inside. When I feel like that, all I can do is walk around. I can't sit still to do a school lesson." Another man in the older age group, a chief boatswain's mate, said, "I have been in the Navy since I was 17. That's 12 years. Now my leg's gone, school won't help me. My mind's a blank. I can't think and I don't care, but I sure wonder what I can do."

Psychiatric evaluation of the amputee patient supports the view that the reaction of Navy and Marine amputees to their injuries reflected the patient's psychologic capacity to adjust rather than a reaction to the type of injury. If a man's personality reactions were stable and if he possessed emotional maturity and the disciplined capacity to adapt himself, the type or nature of his amputation was irrelevant. Whereas, if, emotionally, maturity was replaced by hostility, aggressiveness, and irritability, this disciplined capacity to adjust was limited. Psychologically speaking, the capacities for loyalty, cooperation, friendliness, discipline, and responsibility were protective to an amputee in his readjustment problems; whereas, hostility, stubbornness, selfishness, unyielding attitudes, and lack of responsibility were handicaps.

Although it has not been possible to follow these amputees throughout their period of adjustment, their prolonged period of hospitalization has revealed a phase of readjustment which is surprisingly uniform. Combat amputees state that their first reaction to ampu-

tation was often confused with their elation at being alive. The aggressiveness, which had prevailed during combat training and actual battle, soon again was manifest in the evacuation amputee wards. Under such circumstances, its expression was largely confined to physical strength and courage.

This chain of interaction was interrupted abruptly upon first contact with life on this continent. This required another phase of adjustment which would have been necessary even though they had not been wounded. However, the presence of an amputated limb distorted and confused what would have otherwise been an easy transition. When among civilians, they became acutely aware of the curiosity of others. When this curiosity was displayed by women, it reflected a much greater disturbance, and the amputee assumed for the first time the full weight of physical abnormality. We saw this occur repeatedly among new arrivals fresh from combat zones. These men were usually depressed by these social experiences.

This was followed by a period in which all contact with society was flavored with the realization of their loss. As they became accustomed to their physical handicaps and adjusted to innocent curiosity, they gradually assumed an attitude of self-confidence, supported by an increasing scope of activity. By the time they secured their prostheses, their adjustments were complete or nearly so. It is indeed fortunate in this respect that they were retained in a hospital where demands necessitated a full environmental contact. If they had been released to their homes promptly, the adjustment phase might well have been prolonged and extremely difficult. Two further observations offer concrete support to this chain of events. Venereal diseases were more common soon after admission than after from 2 to 4 months. The incidence of marriage became apparent at the fourth month and increased until the time of discharge.

FOLLOW-UP DATA

Follow-up contact has been established on 219 of the discharged amputees. Information gathered from follow-up questionnaires reveals that 134 are working, all but 15 on a full-time status. In addition to working, 7 men are attending school or college and 4 others plan to enter at the next semester. Thirty-five stated that they were carrying on with their old jobs, while 4 men had returned to duty in the Navy. The remaining 91 had secured new employment. Fifteen amputees found work through their friends, 13 through Civil Service, 8 through U. S. Employment Service, and 3 through the Veterans' Administration. Fifty-three had secured work on their own initiative without outside help, while 42 failed to state how their job was obtained.

Twenty-one amputees were performing manual labor, forty-three were engaged in clerical work, and ten in special work. Sixty did not answer the question. The range of accomplishments were noted in the following occupations: Radio announcer, professional football player, newspaper reporter, and two who succeeded in getting elected to public office. Five amputees now operate their own businesses.

Very few of the discharged amputees availed themselves of their educational opportunities. Twenty-six were going to school. This includes the seven mentioned above who were also working. Four men were planning to go to school, while two started to school and dropped out. This low educational rate is not surprising in view of the maturity of these men.

The greatest potential problem group included the 66 men who were neither working nor attending school. Five of these patients had severe physical handicaps, which probably explains their inactivity. As previously stated, four of these men planned on entering school or college, while four of them had worked but quit, and two had been in school and dropped out. Fifty-one amputees who are physically able to work or attend school did not indicate on their returned questionnaires that they had worked or contemplated working or securing training. These men in particular represent failures to make adjustments.

These sixty-six cases represented 30 percent of those who answered the questionnaires. This proportion of inactive, discontented and maladjusted amputees will unquestionably increase when economic competition becomes keener. It is also true that the patients discharged represent a slightly older age group than the patients now under treatment. The older men will very likely do better than those who were taken into service before they reached the age of mature vision. These younger men lack foundation and have had no previous experience with work.

The emotional problems of the readjustment of the amputees to work are illustrated by the following letters:

"Two weeks after my release from the hospital, I started to work for the U. S. Government (Civil Service), which I am urging every veteran to do. It is good steady work and pays well. My duties are that of an inventory checker. This consists of inventorying for the Maritime Commission every part of a ship which enters the port of Baltimore. Now for my prosthesis. From the day I stepped into civilian life, I have never had the arm off during the day. As for the stump, well, that too is mighty healthy and the only thing I feel is the arm which isn't there. This I understand cannot be helped, so I just don't let it worry me. I have fully adapted myself to civilian life and do not regret a day of my experience."

"I have had no trouble with my stump, but have an ache in my left shoulder blade and above, which I have had since the amputation of my arm. But it

isn't enough to even mention. I was fortunate enough to have a business to return to, working with my Dad. I was quite nervous at first, getting accustomed to civilian life again. I first tried a desk job, but soon became dissatisfied and requested to be out among the public. I now hold the position of Sales Manager and Route Supervisor over the three plants now in operation."

"This is a funny question, but what would you say to it? Is there any chance of getting back in the Navy on limited service, or at least some branch—anything? I just can't stand this civilian life. Say, could I give my left eye to some blind guy down there: how about it? I've heard it would work and it might help some guy a bit. Well, my leg is pretty good, but please see what you can do about my getting back, or help some guy out."

SUMMARY

1. Amputee patients retain their normal personality reactions.
2. Of 350 amputee patients evaluated from the psychiatric viewpoint, 308 were friendly extroverts. Thirty-seven were quiet extroverts with similar but more inhibited personalities. Only 3 had seclusive traits, and 2 possessed the impulsiveness and inability to profit from experience, associated with constitutional psychopathic inferiority.
3. There were no neurasthenic, psychasthenic, hysterical or psychotic reactions among the amputee patients.
4. Eighty-three percent of amputees adjusted readily to their injury and prolonged hospitalization. This group represented the emotionally mature patients with strong sense of responsibility and good motivation.
5. Seventeen percent had some difficulty in adjusting to hospital routine; this group represented those who were more insecure emotionally. This difficulty was expressed by the development of periodic hostility.
6. Amputees who were battle casualties adjusted more easily than those whose amputation resulted from accidental injury or disease.

XIII. AMPUTEE EDUCATIONAL REHABILITATION AND PREVOCATIONAL TRAINING

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Academic and vocational training are fundamental factors in the rehabilitation of amputees and have played a constantly more effective and important role in the program at this hospital. Although veterans' legislation has established a program of vocational rehabilitation for patients following their discharge from the service, the Navy long ago recognized that educational, psychologic, and social phases of rehabilitation must be engaged in concurrently with the surgical and medical work in order to return personnel to civilian life as well adjusted individuals. In consequence the Educational Services Office in this hospital, a well-established department already engaged in promoting off-duty studies, was charged with the responsibility of providing vocational and educational counseling and prevocational and academic training for all amputees.

Accordingly, by 1 April 1944 the Educational Services Office was in the process of organizing a service which has since that time included every amputee in its counseling and has enrolled 70 percent of them in a completely voluntary program of education. The purpose of this paper is to show how this has been done, what difficulties have been encountered, and what success has been achieved.

In any discussion of this sort it is important to understand the attitude of enlisted men in general toward education. Special mention will be made later as to the participation of officers; for the present the program as it concerns enlisted personnel only will be discussed since they comprise by far the greater percentage.

The average enlisted man in the armed forces has had less than tenth-grade education and a high percentage did not attend high school at all. This indicates, of course, a great need for an educational program among those who have sufficient off-duty time to work at it. Unfortunately, however, crying need and reasonably adequate facilities do not add up to a successful educational system. Incentive and desire must be present, and figures indicate that on the whole such incentive and desire have been lacking. The Navy's Educational

Services program, with educational services officers everywhere in the world where there are Navy personnel, has lifted the Navy's participation in education considerably above the level of the armed forces in general.

The reason for the general disinclination for education is found in several sources: A dislike of books and school in general, stemming from gaps and omissions in early schooling, and an instinctive preference for the use of the hands rather than the mind; the long-standing myth throughout the war that the outside world is filled with jobs paying \$100 a week or more regardless of education or technical training; the stigma placed on anyone who volunteers for anything; and finally the feeling that there is no point in starting something that one won't continue after discharge. The fundamental desire is to get home, get married, and settle down to the normal existence of which the war has deprived them. And school to these men is not a normal existence.

Additional factors affecting the educational program, factors which are peculiar to amputees sent to Philadelphia, may be summarized as follows: (1) The psychologic effect of amputation frequently deters patients from any program not directly connected with the restoration of a lost limb; (2) distance from home and long-time severance of family ties often make constructive plans prior to discharge an irritation rather than a help; (3) local distractions in the city such as movies, ball games, bars, and social opportunities discourage a voluntary program of education; and (4) the most effective type of program, that provided for ambulatory patients, may be interrupted or terminated abruptly by the inevitable recurrence of surgery.

Nevertheless, the fact remains that 70 percent of all the amputees admitted to this hospital have participated, voluntarily, in some degree in the educational program. The personnel dealt with have been on the whole of higher caliber than throughout the armed forces in general, the educational services officers and enlisted personnel have done a first class job of motivation, and the city of Philadelphia, while distracting many, has also attracted many by its generous support in the way of providing splendid educational facilities. It seems extraordinary that there should be such a difference in regard to the no-high-school and the high-school graduate groups, but it is just this difference that has helped to boost the educational program in Philadelphia, for statistics show that those with least education are the least likely to be interested in going further.

When the rehabilitation work got under way the staff consisted of one male officer, two WAVE officers, one enlisted WAVE typist, and a patient assigned to master-at-arms detail. The staff reached its

peak in September 1945 with two male officers (one a Marine), four WAVE officers, two enlisted men, two enlisted WAVES, four patients, and six civilian volunteers supplied through or by the Red Cross. As the educational services staff was responsible for all patients in the hospital, only two officers and one enlisted man were able to devote their entire time to amputees. Educational services therefore reached beyond the hospital walls for help and found Philadelphia schools and industry the solution.

TABLE 1.—*Educational level of amputees*

	Armed Forces (percent)	Phila. Naval Hosp. (percent)
No high school.....	41	17
Approximately tenth grade.....	36	45
High school graduate or more.....	23	38

37 percent of amputees at this hospital had less than 2 years' service, and 63 percent had over 2 years' service. 39 percent were under 21, and 61 percent were over 21 years of age.

As soon as it is practical to do so after his admission to the hospital, each amputee is interviewed concerning his educational and vocational future. As there is no compulsion involved in this system, the initial interview and the exit session some months later may possibly be quite unproductive. But for those 70 percent who wish to participate, thorough counseling follows the initial session and two objectives are set up: An immediate objective which can be attained during hospitalization and an ultimate objective which in some cases may not be reached until some years after discharge. The next step is to design a plan by which the amputee may attain both of these objectives.

For example, the ultimate objective for J— C— is being a mechanical engineer, but C— left school in the eleventh grade. His immediate objective is to get a high school diploma, with emphasis on mathematics and physics; his ultimate objective is to go to a good college for engineering. The former is accomplished within the hospital by accreditation procedure through the Armed Forces Institute, and instruction in solid geometry, physics, and American history; the latter is accomplished when he becomes a veteran, under Public Law 16 which entitles him to 4 years of education.

Another rather different but nevertheless common example is that of H— C— whose ultimate objective is being a watchmaker. His immediate objective is fundamental knowledge of watchmaking to give him advanced standing in apprenticeship following discharge; his ultimate objective is to become a journeyman watchmaker. The former will be implemented by training at one of Philadelphia's vocational schools prior to discharge; the latter will be arrived at

by apprenticeship for 3 years in the watchmaking industry itself, with financial aid from the Veterans' Administration under Public Law 16.

As has been stated earlier, incentive and desire are the factors which must be present, regardless of need and available facilities. Happily, with a fair number of cases these are already present. With others, they can be established by tactful approach and handling. Thus it is that the initial interview may be of very considerable importance. If good rapport between interviewer and patient is not set up at that first meeting, the chances of accomplishing anything are very remote.

Each hospital has its own system of establishing this rapport, or at least of making the initial contact with the patient. This hospital has attempted two methods; (1) the routing slip interview in the office and (2) the informal ward visit. The latter has been found to be the more successful. Daily admission reports inform the Educational Services Office as to who the new patients are and where they are located, with the result that the interviewer can inform himself or herself of the pertinent background information in advance and approach the patient at an appropriate time and avoid inappropriate questioning.

The personality and experience of the interviewer are of prime importance. The ideal initial interview is so informal that it does not appear to be an interview at all. It is rather a general conversation on apparently irrelevant matters which eventually winds up with a revelation of the aim of educational services to aid the patient to make his long stay useful in terms of the future. At this point, however, it has been found that it is vitally important to stress the down-to-earth quality of the program. It is fatal to say, "O.K., we'll give you a book on auto mechanics so you can study to be a garage mechanic." Instead, one says "I'll see you next Tuesday at 10 o'clock and we'll help you figure out what would be the best bet for you, and if it turns out to be auto mechanics we'll arrange, as soon as the doctor says it's O.K., for you to go to work for a month or two at General Motors or Greyhound." That sort of interview is sure-fire.

The session scheduled for "next Tuesday at 10 o'clock" would be a painful one without the preliminary build-up, but it is easy now. It is not pertinent in this paper to go into all the details of the principal counseling interview, but the counseling "tools" used, or at least available, should be mentioned. If the man's service record or his previous hospital report is complete as to interests and aptitudes, testing is not necessary, since the Navy and Marine Corps battery of tests recorded on qualification cards give adequate information in

this direction. When such information is lacking, it may be necessary to give a few tests, such as the Kuder or Strong Vocational Interest and certain of the Navy tests, such as the General Classification test and mechanical and clerical aptitude tests.

When the immediate and the ultimate objectives have been selected, the plan for implementing the counseling is then drawn up. This may follow one or more of a variety of lines to suit the individual's need. When high school graduation or college admission are involved, accreditation for Navy experience is the first step, followed by self-study, or individual or group class instruction within the hospital, or even academic instruction in the city's veterans' high school or one of the local colleges. If the plan is vocational, it is accomplished to a limited extent within the hospital, but primarily by way of prevocational training within one of Philadelphia's industries or one of the city's fine vocational schools.

ACCREDITATION

Before any intelligent academic program can be set up with the view to getting a high school diploma or going on with college work, it is necessary to get in touch with the school involved, to find out how much credit will be granted for in-service or off-duty education, and what additional courses are required or recommended. The U. S. Armed Forces Institute, in cooperation with educational services and all educational institutions, has made this procedure easy and effective. A form entitled "Application for Credit for Educational Achievement" is filled out, informing the school of the man's entire educational experience in the service, including billets he has held, schools he has attended (with attainment grades), etc. This information is drawn from the man's service record and is certified on the form by the officer. Also, where it appears to be to the man's advantage, General Educational Development tests, also provided through the Armed Forces Institute, are administered showing how, for example, the man who left school in the tenth grade, 4 years ago, now rates in comparison with the high school graduate from the area in which the school is located.

All schools and colleges have been provided with a handbook interpreting the Navy billet and school set-up, as well as the General Educational Development tests, suggesting but not requesting the amount of credit in terms of good academic standards. A letter covering these data is sent along with the reports, with a request that the school inform the man or the officer of action taken.

In about 5 percent of the cases immediate diplomas have been granted; in 50 percent diplomas have been promised upon completion of from one to three courses; the other 45 percent have required four

or more courses, but the majority of these cases have been those of men who either had less than tenth-grade schooling or had little or no real training in the service. Where more than three courses are still required, it has been found that the average patient does not wish to tackle the job; a small minority will tackle anything.

SELF-STUDY

In the implementing of the academic or vocational program self-study has a place, though a small one as far as effectiveness is concerned. The Armed Forces Institute has provided an admirable supply of "self-study" or "self-teaching" texts covering virtually all academic and vocational subjects as well as correspondence courses in even more subjects. The latter are supplemented by courses supplied and sponsored by a large number of cooperating colleges and universities. Credit is obtained upon completion of either self-teaching or correspondence study by end-of-course examinations, and nearly every school and college in the country accepts these results for credit. Correspondence courses furnished by the Institute are free, following payment of a \$2.00 registration fee, and those obtained from colleges are half-price for service personnel. The Marine Corps Institute similarly supplies correspondence courses entirely free of charge and in addition provides a special accreditation procedure.

It has been found that self-study, taken literally, has not been a great success among the amputees. A total of 14 percent have limited themselves or have been limited to this phase of the program, but progress in their cases has been slight, and only two or three course completions can be expected out of 100 candidates. Consequently, except for patients who refuse to participate in any other way or whose requirements cannot be met by available teachers or outside training facilities, self-teaching texts and correspondence courses have been used principally as tools for individual supervised instruction or group classes.

INDIVIDUAL INSTRUCTION

In a hospital situation, at least such as exists in Philadelphia, the most satisfactory on-the-compound educational program has been through individual instruction. Obviously a very large number of patients cannot be reached in this manner, but more course completions have been registered in this way than in any other. It is not necessary to meet a student more than once or twice a week to keep him going; often a 15-minute session weekly has been sufficient. With the amputees, individual instruction has been provided in typing, radio, mechanical drawing, art, English, mathematics, history, accounting, and foreign languages. Ninety men, or approximately

12 percent, have had such instruction. The teaching has been provided by members of the educational services staff, patients, and a number of extremely able civilian volunteers. Some of the instruction has been at the bedside and some in the classrooms.

GROUP CLASSES

Ideally the educational services department in the hospital would be a model school with an all-day class schedule for groups of patients with common needs and interests covering most academic and vocational subjects. Regularly scheduled group instruction, however, is incompatible with the exigencies of hospital routine. Nevertheless 60 amputees have participated in such classes, including business law, insurance, architectural drafting, radio, electricity, advertising, and journalism. These courses were reasonably successful in spite of the handicaps described above, chiefly because their nature made it possible for patients to miss class several times in succession without sacrificing the continuity required in ordinary academic subjects. Group classes in languages, mathematics, English, and history never proved to be a success because the patients represented too wide a spread in academic advancement, intellectual ability, and objectives, and one or two missed classes were an incalculable loss. Hence, it may be seen that the individual instruction system is most satisfactory for academic work.

PREVOCATIONAL TRAINING IN INDUSTRY

The Philadelphia Board of Education has been most generous in opening the doors of its vocational schools and one of the evening academic schools to Naval Hospital patients. In addition three local colleges have been available to patients without charge. The Pennsylvania Bureau of Rehabilitation was instrumental in helping the hospital educational staff to make these arrangements with the schools and agreed to pay whatever fees were required of men attending private institutions. With amputees a very small percentage were able to take advantage of these splendid opportunities because interruptions such as further surgery, leaves, and treatments of one kind or another made long-term programs requiring regular attendance every day rather difficult. About 4 percent have participated so far. Easy access by public transportation made it possible for unilateral leg amputees to attend on their own.

PREVOCATIONAL TRAINING IN INDUSTRY

The greatest single contribution to the vocational rehabilitation of the amputees has been on-the-job training within Philadelphia indus-

try. Two hundred forty men, or 32 percent of the total number of amputees, have benefited from this system.

Late in 1943 an arm amputee who had formerly been a meat cutter was sent to one of the local companies to determine whether a one-armed man, aided by a prosthesis, could regain his skill at cutting meat. This was an experiment sponsored jointly by the rehabilitation officer, the officer in charge of educational services, and the Veterans' Employment representative of the U. S. Employment Service. The experiment was a success, so when the General Electric Company shortly afterward offered to train amputees in mechanical drafting at their local plant, it was agreed that enlisted personnel might work in industry and accept remuneration if the work was recommended by the educational services officer, approved by the patient's medical officer, and obtained through the Veterans' Employment representative of the U. S. Employment Service, as a fundamental part of the patient's rehabilitation.

Regulations were set up by the educational services officer to determine eligibility for the training, as follows: The man must either (1) be unable to return to his old job because of physical handicap; (2) be uncertain as to his ability to do his former type of work without experimentation and retraining; (3) be in need of training for a new occupation which his Navy or Marine Corps experience has uncovered; or (4) have never had a civilian job.

At first thought it might seem that this would include all the patients. However it excludes a large number whose sole motives are the remuneration and the liberty involved. This exclusiveness probably has been one of the reasons for the program's success. The primary reason, however, has been the opportunity it has provided to return men to a normal civilian environment in which they have been able to regain confidence in themselves.

It should be stressed at this point that the amputee's prevocational training job never in any way has interfered with his surgical or medical care; his discharge from the hospital was never delayed pending completion of his training; no men have suffered second injury; the Veterans' Administration has welcomed this prevocational rehabilitation; there have been no difficulties with labor unions; and employers have been unanimous in their praise of the work turned out, as well as grateful for the opportunity to discover that amputees, even before they have their prostheses, are not really handicapped men if they are well placed and well trained.

There are two difficulties in prevocational training in industry; namely, checking up on the men to be sure that they are on the job and making a good adjustment to their new situation, and checking up

on the employers to be sure that the men are getting training. The first is easy enough when one has sufficient personnel to send out properly qualified representatives to visit the men at work and to go over problems with employers.

Following V-J Day, prevocational training in industry has necessarily been greatly curtailed. Cutbacks in contracts required the immediate elimination of about half of the men out at work. But the 240 men who have had training in some 100 different Philadelphia industries have been given a lift on the road back to civilian life. This is of great importance and is reflected in the morale of those who are still here, as well as in the letters of those who have been discharged.

CIVIL READJUSTMENT

The final step taken by educational services prior to an amputee's discharge is the exit interview, an integral part of the civil readjustment program. The civil readjustment officer, in a general lecture, explains the opportunities for further training provided by the Veterans' Administration under Public Law 346 (G. I. Bill) and Public Law 16 (Vocational Rehabilitation Act), and then the educational services officer has an individual interview with each man before he leaves. Since most amputees have already been counseled previously concerning their long-term objective, this exit interview is usually merely a final check-up to tie together loose ends, evaluating progress to date, and pointing the way to the next step to be taken following discharge, including the forwarding of any pertinent information concerning the training acquired in attaining the objective set up at the beginning of the program.

OFFICER PATIENTS

Although officers have been informed of the opportunities afforded by the program, relatively few have participated until quite recently. Since V-J Day an increasing number have taken an interest in getting a year of graduate work and several have enrolled in classes at the local colleges under the auspices of the Pennsylvania Bureau of Rehabilitation. On the whole, however, the officers have indicated that their plans for the future are well made and that they need no supplementary training. A very high percentage, of course, are college graduates. One of the WAVES from the educational services office has the job of seeing every amputee officer soon after his admission to inform him of his opportunity to go to a local college as soon as he is ambulatory and to get supplementary training after discharge from the service.

**EFFECT OF BACKGROUND ON FUTURE PLANS AND PARTICIPATION
IN PROGRAM**

Statistics show that the median level of education is about tenth grade; a high percentage have been in the service over 2 years and are 21 or more years old. It becomes evident on examining table 2

TABLE 2.—*Future plans of 769 amputees*

Background (percent)	School (percent)	New job (percent)	Old job (percent)	Undecided (percent)
No high school (17 percent).....	3	31	51	15
Approximately tenth grade (45 percent).....	15	40	22.5	22
High school graduate (38 percent).....	38	26	20	16
Less than 2 years' service (37 percent).....	22	24	25	29
2 years' or more service (63 percent).....	22	38	27	13
Under 21 years (39 percent).....	30	24	20	26
21 years or more (69 percent).....	15	38	30	17
Totals.....	21	32	26	21

that those with the highest grades of education are the ones who want education most, and conversely those who have least (and perhaps need it most) are the least inclined. Amputees with the least education are also most likely to return to their old job, whereas the tenth-grade level group are those who want to try something new. Men with the shortest service experience and those in the lowest age group are the slowest to make up their minds about future plans.

TABLE 3.—*Academic participation in program*

Background (percent)	Self study (percent)	Individual instr. (percent)	Group instr. (percent)	Phila. schools (percent)	Total (percent)
No high school (17 percent).....	9	2.5	6.5	0	18
Approximately tenth grade (45 percent).....	19	15	9	1	44
High school graduate (38 percent).....	12	12	7	1	32
Less than 2 years' service (37 percent).....	15	14	7	0	36
2 years' or more service (63 percent).....	14	12	9	1	36
Under 21 years (39 percent).....	20	14	9	1	44
21 years or more (69 percent).....	13	11	6	0	30
Totals.....	14	12	8	1	35

Academic participation in the program, as shown in table 3, has been greatest in the tenth-grade, under-21 group, with self-study and supervised individual study leading in popularity.

Table 4 shows the enormous popularity of prevocational training, particularly with the more mature men; high school graduates, men with over 2 years' service, 21 years of age or older. The grand total of participation, both academic and vocational, reaches 70 percent, with the high school graduates at the top with 77 percent, and the no-high school group lowest but nevertheless participating well beyond the 50 percent mark.

TABLE 4.—*Vocational participation in program*

Background (percent)	Prevoc. training (percent)	Phila. schools (percent)	Total (percent)	Grand totals (percent)
No high school (17 percent).....	30	5	35	53
Approximately tenth grade (45 percent).....	26	3	29	73
High school graduate (38 percent).....	40	5	45	77
Less than 2 years' service (37 percent).....	22	7	29	63
2 years' or more service (63 percent).....	36	1	37	73
Under 21 years (39 percent).....	23	5	28	72
21 years or more (69 percent).....	35	3	38	66
Totals.....	32	3	35	70

FOLLOW-UP

Figures obtained from 200 follow-up letters from amputees already discharged show that approximately the same number of men who planned school have gone ahead with it, fewer have gone back to old jobs than had expected to, and a much higher percentage have taken new jobs, or are being trained for them, than had been anticipated. The number of those with no activity is no indication that these men have not made satisfactory adjustments, since a considerable number had been home only a month or so when the letters were written. Where training or schooling is involved, the men are taking advantage of the Vocational Rehabilitation Act (Public Law 16), to the provisions of which they are all entitled if their amputation is a vocational handicap. New jobs were obtained in about 50 percent of the cases through the official agencies such as U. S. Employment Service, Federal Civil Service, and Selective Service, but in a surprising number of cases the men say they got their jobs "on their own."

TABLE 5.—*Follow-up figures, 200 cases*

	Percent
Back to old job	20
New job	38
School or college	20
No activity yet	22

SUMMARY AND CONCLUSION

Contrary to the thesis put forth by certain writers, the enlisted man does not reject education if it is offered to him in reasonably palatable form. At least that is the experience of those engaged in the educational rehabilitation of amputees at the Philadelphia Naval Hospital. Certainly a voluntary program of education that reports 70 percent participation must be termed a success if the results show that the participation really accomplished something. This cannot be accurately measured at this time nor perhaps at any time, since much of the accomplishment needs to be measured in terms of the

man's whole adjustment to civilian life. The follow-up letters are encouraging in this respect, with 78 percent of the men evidently settled in a satisfactory job or school situation. The most accurate measure that can be taken at this time is in terms of further education. If only 1 percent of all those discharged during the first 8 months of the "G.I. Bill" took advantage of further education, while 20 percent of the amputees from this hospital went back to school, there is good reason to believe that the educational program at the hospital had a generous hand in supplying the necessary incentive.

The main factors, of course, are space and personnel. A really first-class educational program for amputees should have a separate ward or building containing three or four classrooms, an examination and testing room, a room large enough to show 16-mm. films to groups of 25 or 30 men, a prevocational training shop containing adequate gear to provide instruction in radio, electricity, Diesel mechanics, auto repair, refrigeration, plastics, and machinshop practice, and finally sufficient office space for three or four interviews to go on at once without confusion. An added touch of value would be a room for an educational library.

As to personnel, the ideal ratio (and the only ratio that would ever be really satisfactory) would be 2 officers and 10 enlisted men to every 500 patients; the enlisted men would require a good educational background themselves, with some experience in personnel work, classification work, or teaching. Lacking such a number of qualified enlisted men, there should be 4 officers instead of two.

XIV. INSTRUCTION IN AUTOMOBILE DRIVING

HOWARD L. CARLIN

Lieutenant (S) U.S.N.R.

Among the requirements for the rehabilitation of amputees is the need to reconstitute habits of confidence and sound judgment, and to develop skills in carrying out the activities of a reasonably normal existence. Driving an automobile is not only a welcome privilege in the modern world, it is also a challenge to the amputee to put forth his best effort in mastering his handicap. Accordingly, it is a determined rehabilitation policy at this hospital to encourage every amputee to undertake the specially designed course of instruction in automobile driving. The popularity of the course and the results obtained amply demonstrate its utility in the rehabilitative process. This report is based on our experiences with 100 amputees in this hospital who have completed the course.

The automobile driving program for amputees was initiated in November 1944. Mr. Arthur Lewis, of the Pennsylvania Department of Highway Safety, acting for Mr. David W. Harris, Secretary of Revenue of the State of Pennsylvania, was instrumental in expediting the preliminary organization and operation of the program. Through Mr. Lewis, the State of Pennsylvania furnished a special car mounted on rollers for use in the clinical laboratory and Mr. Lewis materially assisted in formulating the teaching curriculum. The City Council of Philadelphia generously granted the use of space in the Municipal Stadium to house the clinical laboratory and permitted us to use the track in the stadium for preliminary instruction.

Appreciation is due the following for donating automobiles for the driving program: In April 1945 a Plymouth sedan was received from the Masonic Military and Naval Service Committee of the Grand Lodge of Pennsylvania; in May the Golden Slipper Square Club of Philadelphia donated a Willys sedan; the National Organization of the American Legion Auxiliary in July and August gave us two Studebaker special sedans with dual control; and in September the General Motors Corporation of Detroit presented us with an Oldsmobile sedan with special training equipment. These donations have enabled us to expand the program sufficiently to provide an opportunity for all physically handicapped patients to learn to drive.

Upon application, the patient is interviewed by the instructor in driving training. He is registered for the course, and biographic data are entered on a form which is used by the instructor to record the patient's behavior and progress reports throughout the instructional period. Pertinent data obtained in the initial interview include the applicant's age, pre-service education and driving experience, the type of amputation, experience with prosthesis, and the like. The nature of the course is outlined, the instructor sketches the nature of the patient's responsibilities, and delineates the requirements for licensing. If the patient elects to take the course, knowing what it entails, he then signs the Pennsylvania State application for a learner's permit, operator's examination and operator's license. These documents are filed until he has passed the driving tests prescribed by the Navy and the State of Pennsylvania.

Regardless of past experience in driving, all patients receive a minimum of 1 hour's blackboard instruction in the elements of highway safety. Concurrently, an objective test is given to determine the applicant's background in this field. Those without considerable experience in driving, or without awareness of matters of highway safety, are required to attend blackboard sessions for a minimum of 3 hours. Except for the special problems entailed in the use of prostheses, all instruction in highway safety is based upon T. Elmer Transeau's unpublished text, *Learn to Drive*.

According to his analysis of the patient's amputation, the instructor then reviews the probable difficulties that will be encountered and demonstrates to the patient the optimum use of his prosthesis in driving. This is individual instruction that is carried on in the Navy's demonstration car mounted on rollers. A minimum of 1 hour's practice on the mounted car is required for the patient to become reasonably proficient. Progress in mastering essentials and the record of scores are entered on each patient's data sheet.

Because of the importance of brake control, a special problem exists for right-leg amputees. They receive extra instruction in the use of their prostheses through practice with the Aetna Reactometer. This is an electrical device attached to the brake and accelerator. When the trainee depresses the accelerator, a light flashes red, green, or amber. On the red flash the student releases the accelerator and depresses the brake. The length of time required to "hit the brake" on signal is automatically recorded on this instrument, and the patient is able to observe his progress with complete objectivity. He continues to practice with the Reactometer until he obtains a performance of five-eighths of a second between signal and response.

At present the Reactometer is being redesigned so that the operation of the clutch pedal may be checked in a similar manner. It may

be of some interest to observe that the training period for proficiency in patients with certain amputations, such as one high on the right leg, may be as much as 8 hours.

The patient's first exposure to heavy traffic follows a session at the Philadelphia Navy Yard State Driver's Clinic, where his reaction, physical condition, possible deficiency in vision, and the like are thoroughly checked by specialists of the State Police. With official assurance that all is well, the instructor then takes the patient through increasingly heavy traffic in the city, and concludes this final phase of the course with a drive through congested districts. The patient must park on a one-way street in a space not much longer than a car length; he must negotiate a U-turn on a narrow street without touching a wheel to the curb or stalling the motor; and he must start his car from a stall on a grade without allowing the car to slip.

Once the patient has completed these demonstrations and has passed a final test on highway safety, he is certified to take the final part of his examination. This driver's test, given by the Pennsylvania State Police at the Philadelphia Navy Yard, is one of the most difficult of its kind. More than one-third of the civilian applicants fail to pass it the first time, even though many of them have driven for a number of years. It is the standard driving test for military permits in the Fourth Naval District and no special consideration is given to amputees.

SPECIAL PROBLEMS RELATING TO TYPE OF AMPUTATION

For instructional purposes the amputees are divided into nine groups in which special attention must be paid to various skills.

1. *High-right-leg amputee*.—This is the most difficult type to train. The major problem involves the patient's ability to move his foot rapidly and easily from the accelerator to the brake and back. Even with an extremely high amputation all other movements made with the right foot can be overcome without difficulty. The patient is inclined to tread too heavily on the accelerator, a habit that must be restrained promptly. Occasionally he has difficulty in using the starter, but since speed is not a factor in controlling the starter, the trouble is usually overcome with a little practice. There were six such amputees who completed the course.

2. *Low-right-leg amputee (including partial-foot amputee)*.—The same difficulties are presented as in the first group but to a lesser degree. The course was completed by 12 such patients, of whom 3 had partial-foot amputations.

3. *High-left-leg amputee*.—It has been determined that for smooth operation of the car, the patient must hold his left foot on the clutch at all times, except when he must use the tilt-switch for

lights during night-driving. He learns to rest his foot on the pedal lightly, without "riding the clutch." The course was completed by 12 such patients.

4. *Low-left-leg amputee (including partial-foot amputee).*—With this type of amputation it is not necessary for the driver to rest his foot on the clutch, for he has sufficient use of his leg to shift his foot from the floor board to the pedal. There were 17 patients in this group who completed the course, 3 with partial-foot amputations.

5. *High-right-arm amputee.*—It is assumed that the hook will be used for driving. The major difficulty is encountered in turning the car. Shifting gears, with the exception of the movement from low to second, is comparatively easy. There were eight such patients who completed the course.

6. *Low-right-arm amputee (including partial-hand amputee).*—Difficulties experienced with the low-right-arm amputees are the same as in the previous group, but in a lesser degree. Of 19 such patients who completed the course, 3 had partial-hand amputations.

7. *High-left-arm amputee.*—Turning is a major difficulty here. Also the rapid use of the hand brake requires much practice. The use of automatic directional signals for turning out of the flow of traffic is advised. In this group, seven men finished the course.

8. *Low-left-arm amputee (including partial-hand amputee).*—A low-left-arm amputee presents the same pattern as the high-left-arm group, but again in a lesser degree. The course was completed by 13 such patients, of which 3 were partial-hand amputees.

9. *Double amputations.*—Among those who completed the course, there were six men who had suffered a double amputation. Two had lost both legs below the knees; another had a below-knee amputation on the left leg and had lost a right forearm; one had a high-right-leg and a low-left-leg amputation; one had a low-right-leg and a partial-left-foot amputation; and one had lost the left arm and some toes on the left. Their difficulties were those of the several combinations of the preceding groups. Yet these patients were able to overcome their handicaps and pass all the tests.

PERFORMANCE AND EQUIPMENT

To date 150 patients have enrolled for instruction in driving. Of these, 100 have completed the training course, and have received Pennsylvania State operator's licenses. At present the average daily enrollment is 12, with an average issuance of licenses of 15 per month. Fifteen percent of the men enrolled in the program have never driven before.

FOLLOW-UP DATA

In order to evaluate our program of instruction and to assist us in teaching men now taking the course, the following questionnaire was mailed to the 75 amputees who had been discharged from the hospital 1 month or more: (1). Do you drive an automobile daily? Occasionally? Average miles per month. (2). Have you had any accidents? If yes, was your handicap a contributing cause? (3). Have you had any difficulty in obtaining a license from your own State? If yes, explain difficulty. (4). Have you applied for a special license, such as "chauffeur's" or "interstate commercial?" Application accepted or rejected? If rejected, state why. (5). Would you be interested in obtaining an interstate commercial license if regulations permitted? (6). Were you able to obtain public liability insurance at the regular rates?

Sixty-seven patients from the District of Columbia and the following 17 States replied to the above questionnaire: Colorado, Georgia, Illinois, Kansas, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Nebraska, New York, Ohio, Pennsylvania, South Carolina, Virginia, Washington, and West Virginia. The reports indicate that 6 patients have not driven a car since returning to civilian life. Forty drive daily and average 500 miles per month. Twenty-one drive occasionally and average 250 miles per month. Four have had minor accidents, but they do not believe their physical handicap was a contributing cause. Two have had difficulty in obtaining a license in their home State. Both applicants were from New York. One of these had an accident before taking his test and it was necessary for him to pass two road tests before he secured his license. The other was discharged from the hospital before he received his final license and had not received it when he filled out the questionnaire.

Six have applied for a chauffeur's or interstate commercial license. All six applications were accepted. Thirty-two advised they would be interested in obtaining an interstate commercial license if regulations permitted. Thirty-two were able to obtain public liability insurance at regular rates. Three advised that they were unable to obtain insurance at the regular rates but offered no explanation. Sixteen stated that they have not applied for insurance and fifteen did not answer this question.

RECOMMENDATIONS

In light of the Navy's experience with driving instruction for amputees, three topics require careful consideration with a view to improving the current situation.

First is the matter of regulations set forth by the Interstate Commerce Commission. Enunciated years ago, before modern prostheses

and modern rehabilitative methods were instituted, these articles specifically state that no amputee may engage in interstate driving. Not only do these regulations take no consideration of the current state of affairs, but also, in their present negative form, work an injustice against a service amputee who may be thoroughly qualified to pass any reasonable test for interstate driving. It is the Navy's experience that many amputees are so qualified, and it is earnestly hoped that the I. C. C. regulations may be so adjusted as not to deny the inclusion of qualified drivers.

Secondly, it is desirable that the present system, that is, the licensing of these amputees in the State of Pennsylvania, be revised. Most of them do not live in Pennsylvania, and encounter difficulties in transferring their licenses to their home States. Inasmuch as the training and the examination of these men is carried out with thorough supervision and at a demonstrably high standard of proficiency, it is recommended that certificates of performance be issued by the Navy in addition to the Pennsylvania State license, these certificates to be automatically valid in any State. There is evidence that the District of Columbia and the following 12 states would honor such certification at the present time: Connecticut, Georgia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Rhode Island, Virginia, and Washington.

Finally, it is urged that various civilian organizations, those interested in automotive regulations as well as those concerned with the problems of rehabilitation, could perform a signal service in supporting and furthering the work done in the Naval training course, and in helping qualified drivers who are amputees to gain recognition for their accomplishments. There will be many other amputees from all branches of the service who will not attempt to take this training until long after their discharge from the services. From the evidence at hand, there is no question about the beneficial character of this training, both as a part of the general rehabilitative process and as a positive means of entering the competition of the labor market in an equal status with unhandicapped drivers.

SUMMARY

The course in driver training for amputees in this hospital is popular and has been very successful in training handicapped servicemen to handle an automobile with a skill equal to that of many normal drivers. Patients are processed through a series of lectures on highway safety, a minimum of an hour's practice with a mounted car in the laboratory, then a graduated series of increasingly difficult driving experiences, ranging from practice on an enclosed track to a demonstration of driving skill in the congested traffic of Philadelphia.

Special problems created by particular types of amputation are given careful consideration, and the necessary skills are mastered in closely supervised practice sessions. Once certified by the instructor, a patient is tested by the Pennsylvania State Police who require the same standard of performance from him as from any unhandicapped applicant.

One hundred men have completed the course of instruction and have received Pennsylvania operator's licenses; daily enrollment is currently 12, while 15 licenses are issued monthly to successful candidates. A follow-up questionnaire on 75 amputees, trained here in driving, who have been discharged from the hospital, shows that 61 of the 67 who replied have continued to drive, and that only 2 had minor accidents.

It is to be hoped that the Interstate Commerce Regulations will be revised so that qualified amputees are not automatically excluded. It is suggested that interested civilian agencies assume responsibility for continuing this type of driving instruction for amputee veterans, and help qualified handicapped drivers gain the recognition they deserve.

C. HEARING AND SPEECH REHABILITATION

I. THE HISTORY AND DEVELOPMENT OF THE PROGRAM

FRANCIS L. LEDERER

Captain (MC) U.S.N.R.

On 15 July 1944 the U. S. Naval Hospital, Philadelphia, was designated by the Surgeon General of the Navy as the national Naval center for aural rehabilitation, to operate under the Office of Rehabilitation, Professional Division, Bureau of Medicine and Surgery. Prior to that date, discussions had been carried on relative to procedures and facilities, and a few patients had already been admitted for this special rehabilitation. Since that time the unit has grown to full maturity and presents a complete service for the reconditioning of deafened personnel. At present 2,787 patients, representing the Navy, the Marine Corps, and the Coast Guard, have been processed at this center.

Inasmuch as our program presents a type of service never before made available to the hard-of-hearing, and that we have had to integrate several special fields in order to achieve our goals, it is felt that there is some virtue in an attempt to outline the history and development of the unit, and to draw attention to some of the significant problems relating both to medical and nonmedical categories in the work of hearing and speech rehabilitation. With such a consideration many pertinent aspects of work with the deafened, in both military and civilian terms, may be illuminated.

PROSPECTUS FOR THE INCIDENCE OF DEAFNESS

In evaluating the mortality and morbidity that was to result from the destructive forces of World War II, many prophetic statements were given in estimate of the numbers of hard-of-hearing personnel. Based on the statistical assumption that some 16 percent of the population of the United States was hard-of-hearing, there were some who were certain that the war would add another 250,000 to the roll of those with an incapacitating hearing loss. World War I contributed no reliable figures, but it was thought that 40,000 men had resultant aural disabilities. Selective Service reported that 4 out of every thousand 18-to-19-year-olds examined had defective hearing, and the Army had taken into its forces 40,000 men with impaired hearing.

Our own service was discharging men with hearing and ear defects at a rapidly increasing rate. Moreover hearing impairment has been seventh in the list of frequency of compensation cases. All of these facts gave foreboding of what was to be expected from World War II.

ESTABLISHMENT OF AURAL REHABILITATION

In establishing an Office of Rehabilitation of the Bureau of Medicine and Surgery, the Surgeon General stated that rehabilitation "shall be interpreted as meaning all activities and services which may be required to supplement the ordinary or usual therapeutic procedures in order to achieve maximum adjustment of the individual patient, either for further military service, or for a return to civil life with the least possible handicap from his disability." To this end the Office of Rehabilitation asked for the coordination and merging of efforts of separate hospitals into a unified medical department program. This office assumed the responsibility for assembling and disseminating information as to methods and procedures of demonstrated value, and for procuring, by consultation with recognized authorities, advice in specific problems. At its disposal were all services and activities required to supplement ordinary therapeutic procedures.

In promulgating directives to all Naval hospitals, it was expected that each hospital set up its own rehabilitation board. It did not seem feasible to us, however, that each hospital undertake the rehabilitation of the hard-of-hearing and the deaf. Accordingly in March of 1944 a proposal for the formation of the Aural Rehabilitation Unit was presented. The chairman of the board at this hospital was Captain Shaar whose able leadership was a stimulus to all of his associates. Our proposal set forth the purpose and aims of the rehabilitation of the aurally handicapped, the types of cases eligible, the physical equipment necessary for the unit, a plan for fitting hearing aids, and facilities for fabricating ear molds. Personnel requirements were analyzed in detail, and the recommendation was made that the Navy organize courses to train its own personnel. Blueprints of an acoustic building were submitted. With the aid of volunteer civilian teachers we began our retraining efforts in speech reading. Meantime exploratory discussions had been carried on by rehabilitative representatives of this hospital with members of the professional medical groups, agencies representing the teachers of the handicapped, and members of the staff of the Department of Public Instruction of the State of Pennsylvania.

From the beginning we sought the counsel of Dr. Walter Hughson, Director of the Otological Laboratory of the Abington Memorial Hospital, who not only served the Navy as consultant to the program

but also made available the facilities of his laboratory for the training of our personnel and for the scientific testing of patients' hearing and the fitting of hearing aids. His guidance in the formative stages of our program was so fundamentally sound that we have had to deviate only slightly from our original planning. His untimely death in September 1944 was a great loss to us, but we feel that the successful development of the Aural Rehabilitation Program remains as a memorial to him.

As already stated, under date of 15 July 1944 the Surgeon General issued a directive establishing the Aural Rehabilitation Unit in Philadelphia as the national Naval center for special service to the deafened. It was directed that all cases of permanent deafness be transferred to Philadelphia with expedition, deafness being "considered to exist when there is a true loss of hearing in the better ear to 30 decibels or more within the conversational range (256 to 2,048) or a loss to 3/15 or more to the whispered voice when audiometry is not available." Once our unit was established, our most earnest efforts were devoted to its rapid development.

DEVELOPMENT OF THE PROGRAM

It was early evident that our efforts must deviate sharply from traditional practices in training the congenitally deaf. We had to deal not with children but with adults, most of whom were in military service only temporarily, all of whom had their hearing disabilities superimposed upon mature habits of communication. It was apparent that so far as the technic of retraining was concerned the factor of speech memory among our patients demanded special attention and educational modalities quite different from those employed in most schools for the deaf. Moreover it was evident that our major concern must be centered in the reconstitution of the patient's personality. Only in these terms could the Surgeon General's definition of rehabilitation be conveyed.

From the beginning the fundamental idea of the aural rehabilitation program has been its centralization in the individual's personality. The task at hand is complex; the psychophysical reconditioning of a person to the point where he is a healthfully functioning person. The goal is the restitution of the *total* person. A man is taught speech reading, fitted with a hearing aid and trained to use it, not merely so that he may again be able to perform certain military duties with efficiency or so that he may get some sort of a job after his discharge. He is taught how to live a complete, full, economically and socially sufficient life in a normal hearing world. Moreover, and equally important, he is educated in the problems of his handicap and taught how to meet those problems intelligently. The ideal of the

effort to rehabilitate the person who has suffered a disabling hearing loss is the development of a coordinated therapeutic relationship between staff and patient to insure the best possible performance of the hard-of-hearing person; he must live with his disability, but he need not be handicapped.

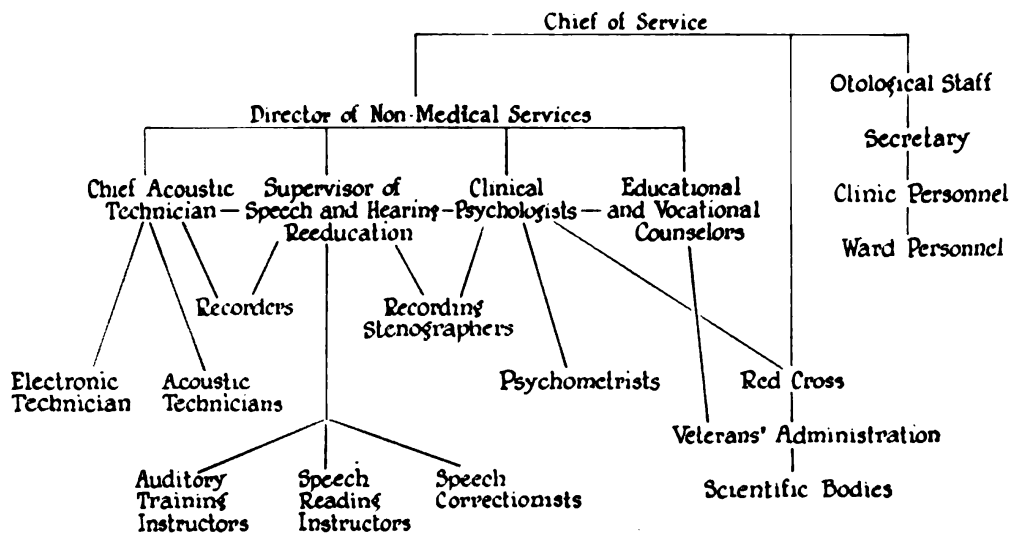
This goal implies the close correlation of a variety of special fields and technics. It was determined to develop a retraining program to include lessons in speech reading, auditory training and speech correction, to incorporate educational and prevocational counseling, practice under careful supervision with an appropriate hearing aid, occupational therapy, physical training, congenial social opportunities and a chance to try part-time industrial training in the city of Philadelphia. All these activities have been carried out.

Procurement of staff personnel

With this achievement in view, we realized that the critical task in the summer of 1944 was to procure sufficient trained personnel to move the work of the unit forward in pace with the number of patients coming to us. It seemed a wise policy to use Naval personnel throughout. Inasmuch as a sufficient number of trained instructors and clinicians were not to be found in the Navy, the Bureau of Naval Personnel made procurement from civilian ranks freely available. Over a period of several months, various specialists in work with the handicapped were commissioned and assigned to this hospital in key posts. One of the first to report was Lieutenant, junior grade, Miriam D. Pauls H(W) U.S.N.R., who serves as Supervisor of Re-education, and brings to this task a wealth of experience with the deafened. Then came Lieutenant Commander H. Koepp-Baker H(S) U.S.N.R., Clinical Professor of Speech and Director of Pennsylvania State College's Clinic for the Handicapped, as director of nonmedical services. Early in the winter Lieutenant, junior grade, Harriet L. Haskins H(W) U.S.N.R., specialist in auditory training, was procured from the New Jersey School for the Deaf. And we were fortunate enough to secure the services of Lieutenant, junior grade, Eva A. Thompson H(W) U.S.N.R., long-time assistant to Dr. Hughson and expert in the problems of selecting and fitting hearing aids, as chief acoustic technician. Later, Lieutenant, junior grade, William G. Hardy H(S) U.S.N.R., speech pathologist and clinician from New York State College for Teachers and Cornell University, was assigned to us by the Bureau of Medicine and Surgery and serves as administrative assistant and aural consultant.

From this nucleus a highly skilled staff was constructed, some members being procured from civilian pursuits, others with experi-

ence in aural fields being transferred from assignments in various Naval activities, and still others trained in an in-service program at the hospital and in the Rehabilitation Training Center set up by the Bureau of Medicine and Surgery at Hunter College, New York. The professional fields represented include otology, psychology, speech reading, speech correction, auditory training, audiometry and acoustics. Another group, composed of occupational therapists, specialists in educational services and prevocational training, physical training instructors and medicosocial workers of the American Red Cross, has been assigned collateral duties in the program. Figure 1 presents an outline of this staff and suggests the correlation obtaining among the various categories of special services.



1. Diagram of staff organization of the Hearing and Speech Rehabilitation Unit, U. S. Naval Hospital, Philadelphia.

In considering its size and the extent of the technical qualifications represented, one might well keep in mind several pertinent observations. Rehabilitation of hearing and speech disabilities is primarily a nonmedical function. After the initial examination, diagnosis, and treatment, the great majority of rehabilitees require relatively little medical attention. Moreover the scope of aural rehabilitation is broad; any retraining that strikes so deeply at the core of an individual's behavior presents many facets, each of which requires expert attention. Admittedly the Naval program has been designed to do the best possible job, considering all aspects of physical facilities and patient-load. Actually many members of the staff are equipped by background and training to perform several different kinds of tasks in the rehabilitative process; because of the size of the patient-load, it has been necessary for the staff personnel to specialize their duties.

Extent of the program

By November 1944 our average patient-load was 125. In January it was about 250, and by March 1945 it averaged over 500. Patients assigned to aural rehabilitation underwent their retraining program for a period of 8 weeks—from the date of admission to this hospital until their appearance before the board of medical survey. The peak was reached in July 1945 when between 700 and 800 were processed each month (the period of rehabilitation having been concentrated, without loss of services, however, in order to meet the exigencies created by this patient-load). Since V-J Day, the load has steadily declined to its current number of about 175. At present we have processed a total of 2,787 hard-of-hearing persons.

SPECIAL TOPICS RELATING TO AURAL REHABILITATION

Our experience in handling such numbers of aural rehabilitees has opened wide vistas of special fields inherent in work with the deafened and the speech handicapped. Many of these will be treated in detail by members of the staff who are reporting their findings in other articles of this series; a few may appropriately be suggested here.

1. It should be borne in mind that we approached the problem of treatment for deafened Navy and Marine Corps personnel with few preconceived notions. The field was new, quite different, obviously, from that of traditional education for the congenitally deaf. The pattern of our program has at all times been kept sufficiently flexible to include new findings; we have proceeded habitually in an experimental frame of mind. It cannot too strongly be urged that further experiment in this work with hard-of-hearing adults be carried on with determination. Our experience has given design to many problems, but this only marks the beginning of a vitally necessary task.

2. We have learned that the classic military hearing tests which make use of the watch-tick, the coin-click and conversational voice are thoroughly unscientific as measurements of hearing acuity. The whispered voice test has been found somewhat more informative, but it is primarily a measurement of a high-frequency hearing loss and requires careful interpretation when it is used institutionally. Aside from the functional tests with tuning-forks, still considered clinically useful for diagnostic purposes, we place our reliance in the quantification of hearing loss by means of audiometry and the measurement of speech reception with an electronic evaluator whose sound-pressure output is adequately monitored. These testing procedures must be accepted and incorporated in new manuals.

3. We have learned much about the performance of a variety of hearing aids. In this work we have been aided immeasurably by the experiments and findings of the National Research Council. We fit only the aids which meet the minimum requirements set up by the Council on Physical Medicine of the American Medical Association and are chiefly concerned that the fitting shall be appropriate to the needs of the individual. The fact that thousands of men are leaving the military service, having been fitted with suitable aids and trained in their use, has given great impetus to the popularity of modern vacuum-tube aids. It is hoped that a generally favorable acceptance by the public will be met by a fair price standard set by the industry so that the hearing aid is within the reach of those who need such sound amplification.

4. As a result of service experiences with the hard-of-hearing and with various technical developments in the fields of physics and acoustics during World War II, a joint military and civilian audition committee is now in process of composition, in order to pursue and disseminate further information in the field. It is hoped that specialists in the problems of hearing and acoustics will keep in close touch with the work of this committee.

5. We have learned much about the rehabilitative process and about the particular problems that obtain in carrying out re-educational procedures for the deafened. Our system of retraining in the skills of speech reading and of auditory training in the use of residual hearing, supplemented by a hearing aid, brings many fresh findings to the attention of the expert. Those of us who are professionally interested in aural disabilities will want to continue these investigations, both for military and for civilian applicability.

6. Our methods of fabricating ear molds have furnished ample evidence that such adjuncts to the individual hearing aid can be produced both more cheaply and better than has heretofore been possible. Without question the individual ear mold is essential to optimum performance of a hearing aid.

7. Finally it is hoped that our experiences with the physical facilities necessary for adequate aural rehabilitation will prove salutary in helping other organizations interested in this work to meet their problems with assurance and dispatch. It is not too visionary to foresee the time when suitable hearing clinics will be available throughout the country for the treatment and retraining of hearing disabilities.

These and related topics will be discussed in a series of eight articles to follow. In these terms we trust that our work at this hospital in aural rehabilitation will prove useful not only for the

reconditioning of deafened Navy and Marine Corps personnel of World War II, but for the advancement of future rehabilitation in the field of aural disability.

SUMMARY

In view of the fact that the establishment of the Naval center for aural rehabilitation at the U. S. Naval Hospital, Philadelphia, presented a new special service to deafened Navy and Marine Corps personnel, and that our experience with nearly 3,000 hard-of-hearing patients has demanded the integration of many medical and non-medical procedures, and broken much new ground in the field of rehabilitation for the handicapped, it was considered worth while to trace the history and development of this unit.

Special attention was given to problems of the procurement of personnel, and to the organization of the staff. The philosophy of centering the rehabilitative effort in the patient's total personality has been outlined, and the extent of the program suggested.

Certain topics of particular interest to otologists and specialists in work with the handicapped have been sketched. These are to be developed in considerable detail, based on our experience with aural rehabilitees in this hospital.

II. THE PHILOSOPHY OF AND GENERAL APPROACH TO HEARING REHABILITATION

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Confronted with the task of rehabilitating the hard-of-hearing and the deafened among Naval, Marine, and Coast Guard personnel, the staff of the Speech and Hearing Rehabilitation Unit of the Naval hospital found it necessary for its own guidance to formulate and to state the philosophies of modern rehabilitationists in such a way as to be applicable to the conditions met in the military service. It is natural that as the program evolved through experience with the problem, a clearer statement of goals and approaches to their achievement was possible.

It now may be observed that the rehabilitation program for the hearing-handicapped is guided by a group of relatively simple ideas: (1) The patient whom we serve is a man who has lost some or all of his hearing; (2) his loss is likely to be permanent; (3) the discovery of this loss and its implications represent for him a major crisis of adjustment; and (4) the man must learn to live as successfully and happily as possible despite his loss.

The task of selecting, training and supervising a staff of specialists organized to attack the problem of hearing loss is at all points conditioned by these four ideas. Likewise any appraisal of its psychophysio-social results is best made in terms of these ideas. Almost at once it became evident that it was very important to emphasize the fact that a hearing loss is significant only when it is considered in terms of the total personality of the patient.

A hearing deficit assumes meaning only when it is viewed in relation to the fact that the ability to hear is one of the basic and essential requirements of personal adjustment. Whatever else it may be, hearing in humans is an important facet of their communicating system. Since the most characteristically human thing about man is his speech, it follows that whatever interferes with its production or reception affects the most important part of him.

It was apparent, therefore, that to help the deafened, it is necessary to answer such questions as: Who *is* the man who does not hear; what has he *been* and what has he *done* in the past; what is he likely *to be* and *to do* in the future? Every process in the rehabilitation program was so set up as to provide answers to these questions and to understand the implications of his hearing loss in terms of them.

The actual significance of a hearing deficit is probably measured less by the number of decibels of hearing loss as shown by objective tests than by the effect of the hearing loss upon personality adjustment. Many patients suffer only slight losses of hearing acuity by measurement, but yet are seriously handicapped. Others have a great depression of hearing acuity and yet appear to be only minimally handicapped. Such differences can be explained only in terms of the characteristics of the individual personality.

Though the numbers of patients to be served during the war and shortly thereafter were large, it was considered imperative that within the limits of personnel and equipment, the rehabilitative processes must be individualized. This intention was reflected in the establishment of special services so organized as to study, treat, and counsel men singly or in small groups, as well as in large classes.

A sincere effort was made to understand the person who suffered the hearing loss and what effect this sensory impairment had upon him, as well as to modify favorably its disturbing influences. It was essential also that the patient, as well as his teachers and clinicians, should come to regard his disability as a permanent and lasting one. It was made evident that his reduced hearing acuity might remain static, or, more probably, grow progressively worse with time. He was helped to accept the fact that his chances of physiologic improvement were too small to run the risk of waiting for them to occur.

By providing facts with which he could think, it was demonstrated to him that medicine and surgery held out little hope for improvement of his reduced auditory acuity. In the usual sense, the hearing loss of the patient cannot be cured. Therefore he was encouraged to accept the more practical course of developing effective structures of compensation that would be as permanent and as lasting as the disorder itself.

The impact of the sudden discovery of the real significance of a hearing loss by a patient is usually disintegrating. If his loss has extended over a period of many years, certain adjustments, largely of the unconscious type, have already been made. In any event the discovery that he is no longer a fully efficient person has been emphasized by his being referred to a hospital and his final transfer to a rehabilitation center. Almost immediately upon recognition of his disability, serious personal insecurities develop. It was found that these insecurities could best be combated by providing the patient with new tools for satisfactory communication, and by developing in him greater objectivity regarding his disability and its effect upon his life while in training and after discharge from the service.

The ability to hear and understand speech is so universal that any impairment of this function in the individual is likely to undermine

his self-respect. He comes to think of himself as peculiar and eccentric. He moves easily into the attitude of self-pity and antisociality. The most positive and prompt deterrents to the growth of these handicapping attitudes are the development of practical skills in communication by the employment of other sensory channels, together with a more effective use of residual capacities. Insecurities are further dealt with by assisting the patient to solve successfully the pressing problems of adjusting to family, associates, and vocation after discharge. He must come to see that he must compete in a highly competitive world, but, more than this, that he can be equipped to meet the competitions with new abilities and skills.

In each stage of the rehabilitation process, and by every teacher, technician, or clinician, the patient is gradually made aware of, and able to accept the view that he is not a deafened man who must find ways to "appear normal," but rather that he is a relatively normal man and must find ways to evidence that he is a successful deafened man. As his rehabilitation proceeds, he comes to see that the handicap of his disabilities is largely conditioned by how he feels about his disorder and what he does about it.

Any clinical and educative practice is unsound if it assumes equivalence of abilities and needs. Hence the process of rehabilitation in the Naval hospital tries to take each man from where he is to where he can go. This results in a patient-centered rather than a service-centered program. It places the emphasis of the training in the more effective place, on the man, the rehabilitee.

SUMMARY

Our experience has justified the use of the principle of treating the whole personality, of which limitation of hearing is a significant but not disproportionately important part. This principle has unified the diverse processes employed in the rehabilitation of the hard-of-hearing and deafened and has given order and direction to the efforts of a variety of specialists who might otherwise attack the problem in somewhat different ways.

III. HEARING LOSS IN THE NAVY AND MARINE CORPS Incidence, Etiology, and Statistical Analysis

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The special rehabilitative service to Naval personnel who have suffered a handicapping hearing loss, established 18 months ago at this hospital, has made possible the accumulation of considerable data. For the purpose of discussion it seemed wise to consider the medical aspect of hearing disability in the Navy and Marine Corps in terms of incidence, etiology, and statistical relationships among various diagnostic categories. These topics are presented, together with a consideration of certain correlative findings, in an attempt to illuminate the problems of hearing loss among personnel of the Navy, the Marine Corps, and the Coast Guard in World War II. Our figures are based on the data obtained on 2,787 such patients thus far admitted to this hospital.

Incidence

During the first 2 years of the war, the incidence of deafness in the Naval service was not particularly startling, but did show a positive trend. In 1942 the total number of medical discharges with reference to diseases of the ear for the Navy and Marine Corps was 1,012. There were 2,010 in the following year, and in the middle of 1944 the total reported for the month of June was 1,646.

Some of the reasons for this dramatic increase were not far to seek. Primary among them was the obvious fact that our Naval forces were undergoing a tremendous expansion during those 2 years. Moreover there can be no doubt that the induction procedure, with its mass examinations, fostered serious oversights and offered many occasions for hasty judgment. By the end of 1943 it had become apparent that deficiencies in hearing would increase consistently, although to what extent not even the most radical observer could then estimate.

A survey of cases of incapacitating hearing loss was requested by the Surgeon General early in 1944. The results reported for the entire Naval service included 135 cases, of which 42 were unilateral and 93 were bilateral deafness. Thirty-eight percent of the bilateral cases were considered eligible for rehabilitation. Obviously, such an estimate was inadequate, a fact that became apparent as soon as the center for aural rehabilitation was established in Philadelphia.

Standards of admission to the Naval Program of Aural Rehabilitation

At the present time 2,787 patients have been processed at the center in Philadelphia. The types of hearing disability dealt with are as varied as might be expected in an organization with the diversified population and duties one finds in the Navy. With but few exceptions, unilateral deafness is insufficient to warrant admission to the retraining program. In general, persons are admitted for hearing rehabilitation who have a loss within the frequency range of conversation (256 to 2,048 cycles per second) of at least 30 decibels in the better ear. This, according to the Navy's standards, constitutes a bilateral deafness that is a handicap.

The level of 30 decibels is not arbitrary. That has been demonstrated as the level of hearing loss at which the patient himself notices a disability; less loss is not always subjectively significant. With a depression of 30 decibels in hearing acuity, the individual finds himself in difficulties, especially in conversation amid noisy surroundings. Actually, the 30-decibel depression is most important in terms of speech reception; as a matter of course, a patient's performance in communicative situations is given primacy over all other considerations of hearing acuity. The 30-decibel standard becomes arbitrary only in the administration of a large hearing clinic; at the center here, latitude is allowed for slight deviations above and below that level, as minimal variations in testing procedures and as individual cases require.

Patient load

The number of our patients during most of 1945 has fluctuated from 300 to 700, most of them spending from 5 to 7 weeks in a highly specialized program of retraining. The great majority of those processed here acquire sufficient proficiency in speech reading and in the use of a hearing aid to enable them to adjust to their environment and live reasonably normal lives. A program was set up which was considered a basic course of instruction under the guidance of an all-military personnel. This was considered important in the maintenance of a discipline that seemed essential in this particular situation.

It may be of some interest to note in passing that almost 40 percent of our patients had defective hearing or aural pathosis before their entrance into the service. The commentary on the induction process is obvious. Countless stories could be told by all those associated with the military regarding how many servicemen "got by" with defective hearing, as well as the numbers who never had a semblance of an

otologic examination or a hearing test. Conditions under which these tests were made likewise present interesting sidelights of the mass induction procedure. In striking contrast, under the Navy's enlistment system, however, the numbers of men admitted with aural disease or hearing defects were minimal. It is, of course, wishful thinking when one assumes that, given the tests and the tools to guide individuals in the "know how" of measuring auditory acuity, any possibility of allowing a person with ear disease or hearing disability to enter the service will be eliminated.

One of the special problems confronting us in Philadelphia is the transfer of cases of unilateral deafness by other Naval hospitals. These persons are not admissible to aural rehabilitation, and usually represent erroneous evaluations of hearing loss in the field. The trouble centers in the audiometry used to establish hearing acuity; in comparison with our own audiometry, which is as accurate as it can be made, differences ranging from 25 to 40 decibels are noted. This state of affairs reflects significantly what happens in all situations wherein operate such factors as lack of proper maintenance of equipment and lack of well-trained personnel.

Etiologic factors

Although the age-range of the patients handled here extends from 16 to 64 years, the majority of them are young men. Age, however, is not a particularly important determining factor in the study of hearing loss, not nearly so important as duration of hearing impairment, and on this point our case histories are frequently indefinite.

The accompanying table, representing an analysis of 2,500 cases, reveals the typical disorders treated in aural rehabilitation. It is not feasible at present to produce an accurate statistical analysis of the relation of deafness, existing prior to enlistment or induction, to various amounts of aggravation incurred in line of duty or somehow related to the service. In evaluating the biography of a case, the board of medical survey gives every reasonable benefit of doubt to a man's claim that his hearing impairment has been so aggravated. To the present, about 93 percent of hearing deficiencies existing prior to enlistment or induction have been recorded as related to the service through aggravation.

Without question some of the categories presented in the table under service-incurred deafness lack exclusiveness. There is an obvious relationship between deafness from heavy gunfire and nerve deafness; and between nerve deafness and an etiologic history of machine noises. No brief is held for the uniqueness of these categories as they are determinable from subjective protocols. We are

somewhat restricted by the military language of diagnosis, and must keep within predetermined groups.

The broad classification, chronic progressive deafness, includes those persons in whom the predominant findings are (1) reasonably normal tympanic membranes, (2) a negative Rinne test, and (3) a gradually increasing profundity of hearing impairment. Audiometric tests here show a mixed loss, and occasionally the patient reports a familial history of deafness. This, however, has not evidenced the classic familial trend. Many otologists would classify these cases as otosclerotic. Reference is made in another article of this series to the Navy's attitude toward the use of fenestration to relieve possible otosclerotic lesions.

Hearing disability that is traceable to heavy firing is classically nerve deafness, with the onset often brought about by exposure to single salvos. It would seem, too, that it is the unexpected blast or salvo which is most damaging to the acoustic mechanism. Incidentally, Naval otologists have observed that it sometimes takes from 1 to 2 years for this type of disability to produce deafness severe enough to be incapacitating. There is an initial high-frequency loss, often total deafness for a few hours and even days, then perhaps a period of general improvement in hearing acuity in one or both ears, followed by a steadily increasing profundity of loss over a period of many months.

There is ample evidence, moreover, of the fact that once an ear has suffered inflammation, it is apt to be hypersensitive to further insults from heavy firing. Many of our patients have been on duty under gunfire in fleet or base operations over long periods of time after the onset of hearing loss, and have thus suffered increasing aggravation of impairment. And it may be of some interest to note that not the big rifles, but the 3-inch and 5-inch guns bring about the most serious acoustic trauma. These guns are often open-mounts, and the blast is sharp and penetrating, usually painful to unprotected ears. Furthermore, the popular description of heavy-fire deafness taking place in gunnery instructors, who have been subjected to acoustic assault over a period of years, has actually occurred in but a small number of our cases. Probably the ultimate in deafness from gunfire came with the admission to aural rehabilitation of a **WAVE** in aviation ordnance whose bilateral hearing loss was evidently caused by the single discharge of a .45-caliber automatic.

Histories are being carefully compiled so that at some future time it may be possible to offer a practical solution to the preventive aspect of deafness from heavy fire. Naval specialists studied the efficacy of various kinds of ear-defenders in lessening acoustic trauma. There is no question, however, that preventive measures have proved

unsatisfactory on several counts. The emergency "general quarters" is no respecter of time or place, and there is evidence that personnel have had to man their guns without so much as cotton in their ears to lessen the concussion. Moreover, some men deliberately avoid the use of defenders, feeling that such protection reflects on their ruggedness and self-sufficiency. Finally, the simple fact is that, for the most part, the ear-defenders now generally in use furnish inadequate protection. A possible exception is a recently designed insertion made of acrylic resin; this has demonstrated exceptional protection in comparison with cotton, the NDRC V-51R, and the modified V-51R DK, all of which are somewhat better than nothing at all. This problem of protection against concussive sound waves needs considerably more study.

It is apparent that the categories of deafness from heavy gunfire and nerve deafness, both service-related, represent similar cochlear involvements. The diagnosis of deafness from heavy gunfire is reserved for those cases in which the evidence is incontrovertible.

So far as the hearing function in nerve involvements is concerned, some interesting observations have been made. A random sampling of 200 cases produced evidence that 56 percent had been exposed to noise and blast, while 75 percent suffered severe tinnitus. Many of our patients report severe headaches, recurring regularly, together with evidence of vertigo. Without question, these data point to a relationship between nerve involvement in general, perhaps even the central origin of deafness of this type, and the symptoms produced by deafness from heavy gunfire. The relation of headache and tinnitus to normal communicative activities is obvious. And, so far as civilian problems are concerned, this whole relationship needs much illumination in terms of industrial accident and compensation.

It is all too evident from the amount of hearing loss in the Navy, and from a careful study of case histories in our files, that a large number of men suffer hearing disability who, for some reason, do not report it. Perhaps the loss has not been sufficiently troublesome to cause serious interference with routine duties; perhaps the individual simply procrastinates; perhaps a man deliberately neglects to report to a medical officer for examination, knowing that he runs a chance of being removed from full duty status. Whatever may be the background of the hearing deficiency, the facts so far indicate that the patient-load of the hard-of-hearing will continue to be heavy, either in military centers or in clinics equipped to service veterans.

Situational deafness

Among various involvements of the hearing function, Naval otologists recognize what may appropriately be termed situational deaf-

ness. This is a case in which a patient reports a history of hearing loss, ordinarily associated with exposure to gunfire, blast or the noise of heavy machinery, and supported by evidence from both functional and audiometric tests. The duration of the disability is apt to be relatively short, however, and occasionally, after a change in environment and the passing of time, hearing acuity improves.

In the meantime, the man has already reported to the medical officer, and through the fear of censure or the accusation of malingering, continues to state that he does not hear. As he is processed from one facility to another, he becomes more and more involved in his deception, and realizing that numerous examinations further his cause, the only way out, the patient figures, is to maintain a now thoroughly trained response to bear out a nonexistent disability. Bizarre discrepancies make this condition evident, and the picture soon clears as the result of an understanding attitude on the part of the medical officer.

Only a few instances of situational deafness have been encountered at the center in Philadelphia. Perhaps one reason for this is that so many of these patients have suffered acoustic trauma for so long before they reach us. In the instance of nerve deafness from heavy gunfire, a man has passed well through the cycle of hearing loss. He has suffered an initial loss, recovered some hearing, then experienced a gradual diminution of hearing acuity, particularly in the higher frequencies; with recurrent exposure to noise and blast this loss has become more profound. Later, after his treatment and training with us, he may recover a little more hearing, but there is no evidence to show any miraculous recovery of full capacity after a serious nerve involvement. The contrary is frequently true.

The Army, on the other hand, seems to find such cases, diagnosed as hysterical deafness, a genuine problem. According to personal communication with the Army aural rehabilitation unit at Deshon General Hospital and with the office of the Surgeon General of the Army, it is understood that about 15 percent of the patients admitted to the Army hearing centers show evidence of deafness more apparent than real. These men are watched carefully, and every effort is made to demonstrate to them that their evident disability is not organic. These cases are subsequently handled in various ways. Some of the patients are thankful when they are shown that their deafness does not originate from any organic basis, while others increasingly become psychologically unstable as the study of their case proceeds.

Yet it is not difficult to account for this seeming disparity between Army and Navy experiences. It is not unusual for an Army aural casualty to be admitted for treatment and training at one of the

hearing centers within 2 months after a severe acoustic trauma. Naval personnel, however, on duty with the Fleet or on foreign stations far removed from ready access to the continent, rarely reach us sooner than 6 months after the initial exposure, and in some instances the period may be as long as 18 months. There is also considerable evidence that many men, specially trained for their assignments, are often reluctant to leave their stations, preferring to try to get along with an aural disability. In other words, Naval aural casualties have gone well through the cycle of typical gunfire hearing loss before we see them.

The Navy recognizes, of course, that there are genuine cases of malingering. We have had no more than six of these, all among the lowest intelligence group, and ordinarily picked up in the routine testing procedures with the exercise of considerable patience and care. More frequently we have encountered men who tried to disguise their deficiency in order to enter or remain in the service.

Situational deafness, however, is quite another matter, a legitimate corollary of exposure to blast and noise. Although the initial deafness may be only temporary, it is nonetheless profound; it is a true sensory experience, and the symptom perseveres long enough to invoke a definite pattern of response to it. With diminution of the symptom, a man finds himself still responding to the behavior pattern of deafness, and is apt to become confused in the attempt to rationalize his recovery of hearing with the recent experience of profound deafness. This confusion leads him to continue to behave as though the symptom were present, and a situation is set up which amounts

Analysis of 2,500 cases of deafened service personnel

	Number	Percent
<i>Deafness existing prior to enlistment or induction</i>		
Chronic progressive types.....	497	19.88
Nerve types.....	378	15.12
Chronic otitis media.....	110	4.40
Totals.....	985	39.40
<i>Deafness incurred in service</i>		
Heavy gunfire.....	664	26.56
Epidemic meningitis.....	28	1.12
Mumps.....	6	.24
Skull trauma.....	27	1.08
Whooping cough.....	1	.04
Machine noises.....	54	2.16
Underwater concussion.....	8	.32
Chronic suppuration.....	90	3.60
Nerve deafness.....	379	15.16
Chronic progressive deafness.....	258	10.32
Totals.....	1,515	60.60

to a *de facto* deception. This is a topic that will require more careful consideration in the future in terms of compensation cases involving aural disability.

SUMMARY

The incidence of hearing loss in the Navy and Marine Corps is considered, and some etiologic factors encountered in a statistical analysis of 2,500 cases of bilateral deafness are discussed. Of these 2,500 patients, 39.4 percent presented evidence of deafness existing prior to enlistment or induction, while 60.6 percent of the cases were incurred in service. Of the cases of hearing impairment existing prior to service, the board of medical survey determined that 93 percent were aggravated in the service; even cases of chronic progressive deafness of long duration showed a profundity of hearing loss that could only have been caused by acoustic trauma.

It must be borne in mind that the etiologic factors discussed are representative only of the patients who were admitted to the Program of Aural Rehabilitation provided in this hospital by the Navy. As with most attempts to produce vital statistics, this summary lacks finality in that: (1) The patients' histories were frequently the basis for judgment of deafness or disease of the ear existing prior to Naval service; (2) voice tests and, frequently, uncontrolled audiometry offered the basis of judgment of hearing loss in the field; and (3) experience with the gradual deterioration of the auditory function indicates the possibility that many Navy and Marine Corps personnel will develop an incapacitating hearing loss in the future which has thus far escaped detection.

It becomes clear that the experience of the military calls forth the best efforts in the measurement of auditory acuity, so that standards for the admission of personnel into the services, for assignments to special duties, for admission to rehabilitation, and for discharge, may be so regularized as to provide authoritative statistics.

Some relationship probably exists between nerve involvements in general and the symptoms produced by deafness from heavy gunfire. Some of the phenomena of situational deafness were discussed, and a contrast presented between Army and Navy findings in this special category of auditory impairment.

IV. PROCESSING AURAL REHABILITEES

Coordination of Medical and Nonmedical Services

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Inasmuch as the Speech and Hearing Rehabilitation Unit at this hospital offers a relatively new special service to Naval personnel, and as, despite its newness, the department has already handled close to 3,000 cases, it is worth while to examine the methods and routine of processing the aural rehabilitees, with particular attention to co-ordination between the medical and nonmedical services.

Several factors have operated to influence the manner in which the department goes about its task of processing. First, the fact that the majority of patients have been hospitalized for periods ranging from 3 to 8 months, while awaiting transfer to the center in Philadelphia, meant that problems of attitude and readjustment must be met and solved without further delay. Second, it is important to realize that, although a general course may be laid down, deafness is a subjective handicap; regardless of the measuring technics available, one must always work with and through the patient's mind. Third, although he is carried in the records as a patient, the aural rehabilitee is usually physically well and active and must be handled accordingly. Fourth, rehabilitation being essentially a psychosocial readjustment to civilian life, the process must circumscribe everything that contributes to a satisfactory social and economic existence. In other words, the department has learned that only a patient-centered program can produce satisfactory results.

The aural rehabilitees are admitted as patients to the hospital by transfer from some other Naval activity, assigned to a ward under the eye, ear, nose, and throat service, and placed under the care of a medical officer who acts for the rehabilitation program. In his initial interview with the patient the ward medical officer, who is an otolaryngologist, secures a thorough history of the present disability. Every effort is made to keep the history concise and simple. Careful attention is paid to the exact time of the onset of deafness, the principal symptom. Because of the relation of onset to the

ultimate disposition of personnel, it is necessary to determine whether a hearing disability existed prior to enlistment (or induction or appointment) and, if it were present prior to service, to know whether it had been aggravated by service conditions. Of necessity the history is predicated upon information from the patient, but data are checked carefully against previous entries in the health record.

It is always to be borne in mind that because deafness is a subjective symptom, it may frequently have been overlooked in the induction process. Moreover, one must consider the fact that many are only too eager to claim injury in the service on the basis of a defect which in truth existed prior to enlistment. The examining officer scrutinizes carefully all claims of deafness from heavy gunfire; not infrequently such claimants have inadvertently made earlier statements which indicate that their loss of hearing antedates their exposure to gunfire or had no relation to heavy firing, either in practice or in combat. In taking the history the medical officer inquires into such symptoms as vertigo and tinnitus, and into the familial history of deafness.

The patient is examined in the acoustical building. Particular attention is paid to the appearance of the tympanic membranes. At this time the perception of conversational and whispered voice is tested, and the Rinne and Weber tuning-fork tests are routinely carried out. If malingering is suspected, considerable time is spent in an effort to unmask it. Attempts at simulation tax the resourcefulness of the examiner and repeated audiometric checks, and the Stenger and the Lombard tests, are often necessary. In the wide discrepancies when these tests are repeated may lie the diagnosis.

Inasmuch as most routine testing procedures have been carried out prior to the patient's admission to rehabilitation, no clinical laboratory examinations are made unless they are especially indicated. One exception is an x-ray film of the chest, which is routine on all patients who have not been so examined within 6 months.

An audiometric test is given to all potential aural rehabilitees in the acoustic laboratory. Here a quantified measurement of hearing acuity is made both for discrete frequencies and for speech reception in a free field. The classic 6-octave range is tested with discrete frequencies, while for measurement of speech reception, a special evaluator, designed under the auspices of the National Research Council and perfected in the acoustic laboratory, is used to determine the perception of normal speech to an accuracy of 1 decibel.

Treatment

The medical aspects of aural rehabilitation were clearly defined as we progressed in our knowledge of what constituted the restoration

of the total person. There enters into the purely medical problem the question of the general physical well-being. We may assume that the upper respiratory tract plays an important role in the causation of complicated infections of the eustachian tube, middle ear, and mastoid process. Then, too, we are well aware of the fact that under certain circumstances, nerve deafness may result from toxic substances, such as may be produced by foci of infection.

All suppurative ears are given conservative treatment, which consists of cleansing the ear, the use of nonaqueous mixtures instilled into the canal, and the insufflation of dusting powder into the middle ear, augmented by inflation of the eustachian tube. A certain number of patients require the removal of lymphoid tissue from the nasopharynx and a number have indications for the removal of tonsils or a submucous resection of the nasal septum. In a few instances, irradiation of the nasopharynx is employed. The majority of patients entering this hospital for rehabilitation have already undergone the usual medical processing, where medical and even surgical care have been instituted, and only after the recognition of an incapacitating hearing loss are they sent to this institution.

Hearing loss as it concerns Naval personnel admitted to the rehabilitation program is of such a degree as to render improvement of the hearing an insurmountable task. If indications for mastoidectomy are to be entertained, they are not based upon improving the hearing which had already been lost. Hearing losses are too great to expect such operative procedures to be remedial. Cases of nerve deafness, moreover, are of such a nature as to preclude the possibility of the restoration of hearing.

During recent years the fenestration operation for progressive types of middle-ear deafness has received attention. The fact that the majority of cases of chronic progressive deafness observed in the Navy existed prior to enlistment or induction, precluded its use in these cases. Also, a close scrutiny of the degree of hearing loss places the majority of these cases beyond the scope of the fenestration procedure; 70- and 80-decibel losses, with marked reduction of bone conduction, characterize this group. There are other extenuating circumstances to be considered, particularly the fact that these cases could not be observed postoperatively over a long enough period of time. Moreover there has been insufficient personnel qualified to carry out the necessary operative procedure. With cessation of hostilities, it was considered more practical to refer eligible patients to doctors in civilian practice who could give them the long continued observation necessary.

The medical treatment of aural rehabilitees consists mainly of the control of annoying tinnitus, headaches, and vertigo. All of those

modalities which have been proposed in the otologic literature of recent years have been applied, and found wanting. The control of tinnitus, especially, still offers a difficult problem, although the majority of patients with this annoying symptom adapt themselves to its presence and, in many instances, find that the symptoms are eventually greatly abated. Headaches constitute the principal complaint, particularly in cases of deafness from heavy gunfire. Repeated study by electroencephalograms has failed to reveal any central change to account for this symptom which has often been of an incapacitating nature.

Treatment of other conditions

Quite apart from the special problems of the ears, the aural rehabilitees have numerous other complaints for which the medical officer is responsible. Malaria, mumps, scarlet fever, appendicitis, pneumonia, gonorrhea, infectious diseases, fractures, acute otitis media, and acute sinusitis, are a few of the conditions encountered. Whenever possible, these are treated in the ear, nose, and throat service; the various infectious diseases are cared for in one of the contagious wards.

Patients in any such population as that of the aural rehabilitation service have a propensity for developing a host of complaints, real enough to them. These are chronic, and the usual history indicates that the patient has gone for months with various symptoms, but carrying on his duties withal; now that he finds himself about to be discharged from the service, he "would like to get fixed up" before he leaves. Dental cavities, back pains, headaches, refractive errors of the eyes, sebaceous cysts, varicose veins, hemorrhoids and multitudinous other ailments are reported. It is well for the medical officer to examine these patients and to refer those warranting further consideration to the appropriate department for examination and treatment. It is necessary, however, to exercise considerable caution in such referrals. In any large military hospital every department is overburdened and each should protect the others. Actually, many of these complaints are trivial, and examination and reassurance by the ward medical officer, together with some minor therapeutic measures instituted by him, will usually suffice.

Once a patient has been admitted to the ear, nose, and throat service and has received his physical examination, he is routed through a series of interviews and meetings designed to facilitate the rehabilitative process by furnishing all necessary data to the specialists concerned. This is an exhaustive procedure that covers a period of 2 or 3 days. Interviews and examinations relate to the technical prob-

lems of hearing re-education, to psychosocial adjustment and to various correlative aspects of hearing rehabilitation.

Initial re-educational interview

Once the functional and audiometric tests have furnished quantitative information on hearing acuity, and the diagnosis has been made, the patient talks with a hospital specialist who is trained in the field of hearing psychology and is thoroughly conversant with all aspects of the rehabilitation program. Every effort is made to learn the patient's attitude toward his disability, toward the necessary re-training effort, and toward his civilian status as a "person who wears a hearing aid." The program is explained in detail, questions are answered, and considerable care is exerted to bring to light personal problems and values that might militate against a reasonably sound psychosocial adjustment. In many instances this interview furnishes the patient his first opportunity to explore his problems thoroughly with a specialist who is completely sympathetic with him. So far as re-educational processes are concerned, it is considered the key to the clinical aspects of hearing rehabilitation.

Thereafter the patient talks with officers who are specialists in vocational training and prevocational guidance, in occupational therapy, and the problems of education. His academic or vocational background is evaluated. The patient learns that many possibilities for work therapy are at hand. Facilities exist for in-training vocational work in Philadelphia's industries, and, for those with backgrounds in trade or business, many temporary jobs are open, offering practical experience in the adjustment to hearing loss under normal working conditions. It is the task of the specialists in these phases of rehabilitation to fit each man into a situation where his particular aptitudes and needs can best be shaped in terms of his hearing problems and his adjustment to civilian life after discharge.

Group therapy

Before he begins his retraining courses, the patient meets with the group of in-coming aural rehabilitees in the departmental auditorium. At this first of several such group meetings, the men are addressed by a member of the staff who sketches an integrated picture of the deafened person's problems of getting along in a hearing world. General and special orientation is undertaken in order that individual adjustments may be made more readily and that the scope of hearing disability and its remedies may be thoroughly aired. Scheduled meetings with medical and nonmedical officers clarify problems of hearing psychology, mental hygiene, care of residual hearing, the use of drugs and stimulants, and vocational adjustment. The men

are given ample opportunity to ask questions and to seek satisfaction of their own particular problems.

One such early meeting is conducted by members of the American Red Cross attached to the department. Medico-social workers acquaint the men with the physical facilities of the hospital reservation, with the recreational and social activities available, and with the types of special service so capably performed by the American Red Cross. The medico-social worker is particularly concerned with problems that relate to family relationships, contacts, follow-ups and the like. She is ready at all times to offer advice and aid in personal matters that so often become vital factors in rehabilitation; without such professional help the task of reconstituting those with a sensory handicap would be immeasurably more difficult.

When a hearing aid is indicated, an individually constructed plastic earpiece is considered necessary. Within a few days after his admission to the hospital, each rehabilitee sits for a mold from which the earpiece is made.

The final stage in the preparatory process consists of a speech reading test whereby each person's capabilities as a lip reader are roughly determined. This allows appropriate grouping in classes, and helps to insure that neither the faster nor the slower lip reader will suffer. The normal re-educational process for aural rehabilitees includes a course in speech reading, auditory training in the optimal use of residual hearing with a hearing aid, the individual fitting of an aid, and both group and individual counseling on problems of hearing psychology and adjustment. At present this program occupies the aural rehabilitees for a period of 4 weeks.

Leave and work-details

It is the policy of the medical officer in command, and of the rehabilitation program in general, to keep aural patients occupied at all times. Aside from hearing loss, the men are for the most part in good health and fully active. A full day in the retraining classes would interfere with normal learning processes. Approximately 50 percent of the average number of patients are employed off the hospital reservation in a program of work therapy; of the remainder, most are assigned to a detail under the master-at-arms and are engaged in various occupations on the reservation, helping the maintenance officer, working as mechanics in the garage, on clean-up details, and the like.

The administration of the program of work therapy and appropriate assignment to hospital details is a complex matter, so complex that a special department has been found necessary to handle it. Accordingly, many of the duties ordinarily performed by the ward

medical officer are delegated by him to a hospital specialist who, with his assistants, working in conjunction with the prevocational training officer, assumes responsibility for organization of the men's time when they are not in re-educational classes.

For the sake of centralizing organizational detail, the matter of leave, too, is allocated to this specialist. The problem of leave in a rehabilitation center is always touchy. Some of the aural rehabilitees come to Philadelphia directly from fleet or foreign duty, having had neither duty leave nor convalescent leave. In general, once a man is admitted to the program, he is discouraged from applying for leave. He is at Philadelphia for so short a time and so many personal problems arise, some real, some imaginary, once he has been home, that it has proved beneficial both to the patient and to the program to hold him at the center until he has completed the retraining course. The obvious exceptions obtain.

Ultimate disposition of aural rehabilitees

When a man has completed his rehabilitation, that is, when all specialists have satisfied themselves as to his proficiency in adjusting to his disability, he is brought before a board of medical survey. At present, there is a well-defined policy, set down in directives from the Bureau of Medicine and Surgery clearly stating the disposition to be made, based on the degree of hearing loss. All men who have suffered their disability in combat and who may still contribute something of their experience and special knowledge to the Navy, may be retained at their own request under the classification of limited duty. They may elect to be separated from the service, however, and they are not encouraged to remain in a duty status if their assignments bring them in contact with acoustic trauma.

The staff of the Aural Rehabilitation Service determines who of the patients are ready to appear before the board at its weekly meeting. Approximately 95 percent of the rehabilitees are unfit for further service and are recommended for medical discharge.

SUMMARY

The task of aural rehabilitation of Naval personnel requires the closest possible cooperation between medical and nonmedical services. Inasmuch as medical and surgical repair of hearing disabilities is not feasible in most instances, much of the rehabilitative burden falls upon re-educational procedures carried out by nonmedical specialists.

Routine clinical and classic surgical procedures are carried out as indicated. Because the vast majority of Naval personnel with hearing disability are not available for further military service, the rehabilitative problem involves a psychosocial readjustment of the

individual to his handicap in a world of sound. Because of the nature and extent of hearing loss among Naval personnel, the processing of aural rehabilitees must be geared to handle large groups of patients; yet each case has individual aspects which must be respected. The staff of the Aural Rehabilitation Center in Philadelphia has developed its procedures with these goals in mind, and in the light of its experience with nearly 3,000 cases has demonstrated how well a thoroughly cooperative processing system can succeed.

V. PHYSICAL FACILITIES AND EQUIPMENT FOR THE REHABILITATION OF HEARING

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The rehabilitation of the hard-of-hearing personnel in the Navy, Marines and Coast Guard is a task of large proportions. To date 2,787 such patients have been admitted to this hospital. In the beginning the rehabilitation program of the Navy was forced to adjust itself to comparatively limited space and equipment. As the program progressed, existent rooms were modified and temporary equipment purchased to facilitate the measurement of hearing loss, the retraining of residual hearing, and the instruction in speech reading.

It soon became apparent that it would be necessary to provide much more adequate and modern facilities for the conduct of this work if large numbers of patients were to be serviced successfully in the time required. A special building was designed and equipment contracted for as a part of an extensive construction program at the Philadelphia Naval Hospital. Completed, this project represents the most modern ideas in design and construction and embodies the most recent advances in electro-acoustic equipment.

The building housing the Hearing Clinic and Re-educational Center is 175 feet long and 65 feet wide, built in one story, with a basement section to accommodate the necessary mechanical equipment. Architecturally the building consists of two parts, the first and larger section being approximately 110 feet long and 65 feet wide. The smaller section is 65 feet long and 36 feet wide. The larger section of the building was designated as the re-educational center. It was so designed as to provide a central corridor throughout its full length. Arranged along this central corridor on either side of this section of the building are nine speech reading rooms, seven offices and special consultation rooms, a waiting room, an otologic examination and treatment room, an auditory training room, a large lecture room, and a special storage room for maintaining an inventory of hearing aids.

The speech reading rooms are sufficiently large to seat 8 to 10 patients. Each speech reading room has a specially designed visual booth in one corner, equipped with a door with a plate glass insert so as to provide direct vision from the room into the booth for train-

ing purposes. It is also equipped with a blackboard, shelves for books and a bulletin board. All rooms have at least one window.

The otologic examination and treatment room is so constructed as to accommodate two examining chairs together with the usual sterilizing and storage equipment. An auditory training room, 20 feet by 15 feet in size, is provided with six telephone booths arranged in groups of three at either end of the room. A platform is constructed in the front of the room on which is mounted certain electronic equipment designed for teaching telephone usage and for use in the usual auditory training procedures.

Adjacent to the auditory training room is a large lecture room approximately 30 by 28 feet. This room is equipped with light-proof shades at the windows to make possible the projection of motion pictures.

This section of the building housing the re-educational center rests upon a separate foundation and is acoustically independent of the second or acoustic section.

Acoustic control

The inside walls of the speech reading rooms consist of 2- by 4-inch studs on both sides of which are mounted composition lath and 1 inch of acoustic plaster. Upon this plaster, 1- by 2-inch stripping is laid to provide the attachment for acoustic tile. The outside walls of the speech reading rooms consist of 8-inch concrete blocks upon which are mounted the usual 2- by 3-inch furring and 1- by 2-inch stripping; upon this in turn is mounted acoustic tile. This construction in both the inside and outside walls provides double air space between the solid construction and the acoustic tile serving as the inner wall surface of each room. All vision booths in speech reading rooms have wall construction identical with that of the speech reading room itself and are thus acoustically insulated from the remainder of the speech reading room.

The outside walls of the auditory training room consist of the 8-inch concrete block with a 2-inch air space followed by 2- by 4-inch studs on which composition lath and plaster is placed. The acoustic tile is mounted on 1- by 2-inch stripping. The inside walls of the auditory training room consist of 2- by 4-inch studding arranged at 8-inch intervals off center and staggered. A 4-inch Ban-acoustic blanket is woven in and out between the studs throughout the whole wall. Upon the lath and plaster is mounted the acoustic tile attached to stripping. The walls of the lecture room were given similar treatment. The walls and ceilings of the corridors were covered with acoustic tile, as are the ceilings of all rooms throughout

all of the re-education section. The floors are covered with heavy linoleum mounted on $\frac{1}{2}$ -inch cork.

Construction of the acoustic clinic

As in the case of the re-educational section, the Acoustic Clinic is so constructed as to be acoustically independent of any other part of the building. It rests on its own foundations and an air space between the re-educational section and itself is provided. The Acoustic Clinic has three rooms for audiometry and specialized auditory training procedures. These rooms have no windows, and are approximately 12 by 10 feet in size. The acoustic section of the building also houses an auditory research room, 13 by 15 feet, a large office for acoustic technicians, two specially designed soundproofed rooms, 12 by 12 feet, each having its own control room adjacent to it but acoustically independent, and a work space for a mechanical and electronic shop.

The walls of all rooms of the acoustic section, other than the sound-proof rooms, are constructed so as to provide an air space between an outside wall of 8-inch concrete blocks, and the inner wall of studding, lath and plaster, upon which is mounted acoustic tile.

The inside walls of the auditory research room are especially well insulated. The inside surfaces of the rooms consist of a special type of perforated asbestos board mounted upon vertical stripping. Behind this is placed a 2-inch acoustic blanket directly against lath and plaster. The whole wall is supported by 2- by 4-inch studs, 8 inches off center, placed in staggered positions, and another 2-inch acoustic blanket is woven between the studs. This room has a vision panel which permits direct vision to the control room serving both rooms, and located across a corridor.

The two sound-proofed rooms are so constructed as to be independent of each other and of the rest of the building. Eight-inch concrete blocks provide the outside wall structure. Inside of this an air space of $1\frac{1}{2}$ inches was allowed. Inside of this was constructed a brick wall independently supported. Another air space and eight inches of concrete blocks followed. Upon this inner cement block wall, $1\frac{1}{2}$ inches of cement plaster was applied and another 1-inch air space was allowed. Next was placed the 2- by 4-inch studding and 2 inches of acoustic blanket. Special perforated acoustic board was then mounted on stripping in contact with the acoustic blanket. Thus these two sound-proofed rooms consist essentially of a room within a room, each standing on its own independent foundations. They are probably as perfectly sound-insulated as it is possible to make them. The reverberation time inside each sound-proofed room is very short.

The special type of perforated acoustic board (not to be confused with acoustic tile), together with the acoustic blanket make an almost perfect sound absorption surface. Acoustic reflection is at a minimum. The space underneath the floors between the footings was filled with loose rock wool to facilitate sound absorption. The vision panel between the dead rooms and their associated control room consists of two plates of glass with air space between them mounted in rubber and felt. Riverbank self-sealing acoustic doors are supplied for both sound-proofed rooms.

Air conditioning equipment

Because of the fact that a large number of rooms in both sections of the building are without windows and all have special provisions for acoustic control, it was necessary to provide an air-conditioning system throughout both sections of the building. All air ducts were lined with special insulating material and a specially designed set of silencing pads was placed in those ducts leading into the sound-proofed rooms of the acoustic clinic, and the auditory research and auditory training rooms in the same section of the building.

Electro-acoustic equipment for clinical auditory tests

This equipment was designed to make possible adequate measures of the impairment of the auditory function. It provides, also, the means for objective evaluation of the compensation by a hearing aid for such impairment. It assists in making an optimum selection from the variety of commercial aids in terms of the individual and true needs of a patient. This equipment also provides for a wide variety of auditory measures.

The principle instrument for such measurement of hearing deficits and for the evaluation, fitting and selection of hearing aids has been designated as a "hearing aid evaluator." Essentially it is an assembly of a two-channel electro-acoustic system of high fidelity. The first channel carries speech, pure-tone signals or other types of signal material to the subject in the sound-proofed rooms. The second channel is used for talk-back from the subject to the operator, for monitoring, and for measuring sound levels in a sound-conditioned test chamber. This equipment was developed at the Central Institute for the Deaf by the Office of Scientific Research and Development of the National Research Council. Acoustic signals are produced by a resistance-tune oscillator for generating pure tone, a phonograph turntable, a microphone for live voice, and a special noise generator to produce a mixture of all frequencies within the hearing range. These are presented to the patient in the test situation. The acoustic signals

delivered through the test channels reach the patient either through binaural earphones or the coaxial speaker. A talk-back channel is also provided and has electrical characteristics identical with those of the test channel. It makes it possible for the operator to monitor continuously the performance of the test channel, and also provides the essential feature of talk-back from subject to operator.

In addition to this specialized electronic equipment for speech reception and general testing, the usual commercial audiometers are employed for making discrete frequency measures.

Auditory training equipment

The purpose of this equipment is: (a) To provide live speech and recorded sound effects for the retraining of residual hearing and the psycho-acoustic reconditioning of persons having varying degrees of hearing loss; (b) to provide known levels of sound pressure and electrical measurements to determine hearing efficiency in group situations; and (c) to provide noise-to-speech ratio measures in auditory retraining situations.

A speaker is mounted on a 90-degree frontal nondirectional baffle in each auditory training room. Each auditory training room is also equipped with an amplifier with a flat frequency response up to 9,000 cycles delivering 30 watts of power. The amplifier provides for monitored speech through an attenuator network to four to eight pairs of Permaflux or similar high-fidelity headphones connected in separately controlled groups of four pairs each. This amplifier also provides monitored speech with an attenuator network to a coaxial speaker having a flat frequency response up to 9,000 cycles per second. In addition to the amplifier, a specially designed turntable operating at speeds of 33 and 78 revolutions per minute with scratch filters for each resonant speed frequency have been installed. A split tone channel in the amplifier is so arranged that the high frequencies can be intermixed with the low frequencies at the operator's wish. Two input channels capable of using a high-fidelity broadcast type of microphone are independently attenuated.

The output network is matched to an indicator calibrated in sound pressure levels (decibels). Each auditory training room, as well as the lecture room, is equipped with a broadcast type of microphone flat to 9,000 cycles with matching elements for use with input channels of the amplifier.

Electro-acoustic equipment for speech reading classrooms

Each speech reading classroom is provided with a single-channelled 30-watt amplifier with output freed from all inductive and power

level hum, with sufficient gain to accommodate any broadcast type microphone. This amplifier is provided with an input channel for use with a turntable with a separate attenuator. It also has two separately attenuated microphone channels and incorporates a split tone channel with attenuators and matching networks.

Each speech reading room is equipped with five pairs of high-fidelity earphones. The earphones are plugged into jack boxes attached to each chair in the room. Each jack box carries its own volume control for adjustment by the patient. The amplifier and the turntable are mounted on shelves inside the vision booth in each speech reading room. A 12-inch high-fidelity magnetic speaker is also a part of the equipment in each speech reading room. It is thus possible to provide controlled acoustic signals for earphones or through the loud speaker.

Electronic equipment for speech correction

Speech correction equipment consists of six magnetic tape recorders and six portable record players with modified amplifiers, jack boxes, and earphones for individual use. Each speech correction room is also equipped with a high-fidelity loud speaker.

SUMMARY

In order to provide the best possible testing conditions as well as retraining facilities, the Philadelphia Naval Hospital found it necessary to construct a specially designed acoustic clinic and re-educational center. This building embodies the latest theories and practice in architectural design and acoustic control.

Electro-acoustic equipment, provided for speech reading, auditory training, speech correction, and the measurement of hearing loss and evaluation of hearing aids, affords a flexible system for almost every conceivable training and measurement use.

Salient points of structural design of the building and of its electro-acoustic equipment have been here described.

VI. TESTING OF HEARING AND FITTING OF HEARING AIDS

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Through the months of processing approximately 3,000 individuals in the Speech and Hearing Unit at the U. S. Naval Hospital, Philadelphia, all types of deafness have been treated. The accurate testing of hearing and the most careful attention to individual needs in the selection and fitting of hearing aids are fundamental aspects of the rehabilitation of the hard-of-hearing person. The rapid progress in the field of electro-acoustics in the past 10 years has provided efficient scientific instruments for measuring hearing acuity and amplifying sound. It is the purpose of this discussion to describe the testing of hearing, the fitting of hearing aids, and concomitant aspects in the Naval program of aural rehabilitation.

Relation of the hearing aid to the hard-of-hearing person

Once the mechanism of the ear is seriously damaged, normal hearing can be regained only rarely. Recent electro-acoustic developments in the production of hearing aids, however, make it possible to compensate in varying degrees for the handicap of deafness. The patient's actual hearing is not changed by the use of a hearing aid. The aid merely amplifies the sound reaching the ear just as does a public address system. Very few deafened individuals have so little residual hearing that they cannot use an aid. In the total number of cases tested for hearing aids in the Navy's aural rehabilitation program there have been only six patients whose loss was so extreme that they could not profit from an aid and training in its use.

Experience has shown that the hard-of-hearing person should receive the benefit of a hearing aid as soon as possible. Psychologically, his readjustment to a world of sound can thus be made fairly readily without allowing time for the development of the negativism and hypersubjectivity that typify the deafened person; socially he is able to maintain reasonably normal communication; economically he does not lose his stature as a sufficient individual.

Audiometry

Accurate testing of hearing is essential not only for diagnostic purposes but for intelligent selection and proper fitting of hearing aids.

The classic hearing tests are neither accurate enough nor do they permit of sufficiently detailed information to serve these purposes. Only by means of modern electro-acoustic test equipment is it possible to determine an individual's actual auditory acuity and range of hearing. The most widely used modern instrument for testing hearing, the audiometer, is now an accepted standard instrument. Additional essential information is obtained from the so-called "speech reception test." At the present time this test requires apparatus that must be specially built; consequently the speech reception test is carried out only in the most modern acoustic laboratories. In the very near future this type of equipment will probably be available for more general use, for the information gained from the speech reception test has proved of such value in determining the degree of a patient's handicap. A brief description of these two tests follows:

A modern discrete frequency audiometer consists of the following parts: An oscillator which produces pure tones (called "discrete frequencies") free from overtones or harmonics, a frequency selector which determines the test tone, an attenuator to control the intensity of the tone, a receiver for transmitting the tone to the ear, an interrupter switch, and a signal button and light indicator to register the examinee's response to the tone.

The Council on Physical Medicine of the American Medical Association has set up rigid standards for audiometers, to which manufacturers must conform, thus assuring perfection of parts and workmanship and standardization of performance. Standard audiometers have at least seven test frequencies and an intensity range of at least 100 decibels in the speech frequencies (256–2048 cycles per second). The *decibel* is the unit for measuring change in intensity and may be defined simply as the smallest change in intensity the average normal ear can detect. The attenuator dial of the audiometer is so constructed that each step is five decibels. Zero on the attenuator represents the average normal threshold of hearing. The audiometer should be carefully checked from time to time to assure proper calibration.

Control of the testing environment is imperative for accurate audiometry. Ideally a sound-proofed room should be used. This is of course not often possible, but it is possible to employ a suitably quiet or sound-treated room for testing. Lack of an appreciation of the ambient noise factor has been responsible for serious errors in diagnosis and in the subsequent treatment of the patient.

The technic of giving audiometric tests is not simple; it is much more than merely a matter of turning the dials on the audiometer. An intelligent, trained operator is needed. Inaccurate results have

been obtained because the technician did not understand the psychologic and pathologic factors which might influence the test, the most important one of which is tinnitus. A trained operator should vary an acceptable standard technic according to the requirements of each test situation. Aside from the presence of tinnitus, important variables include the patient's attitude toward the test and the fatigue effect. Optimal results are obtained primarily by the operator's alertness to all test factors and his conviction that any test worth doing is worth doing well.

The technic used in our program is rapid, accurate and simple. The patient is seated so that he cannot see the panel board of the audiometer. He is instructed to listen just as he would on a telephone and to press the indicator button whenever and as long as the test tone is heard. The middle-range frequency, 1024 cycles, is presented first at a comfortable level; approximately 20 decibels louder than the patient's estimated threshold. This frequency is chosen as a starting point because it is the easiest frequency to hear and because there is less variation in response to this tone than to the higher and lower frequencies. The faintest intensity which can be heard by the patient is determined by changing the attenuator, care being taken to interrupt the tone while the change is being made. The reading obtained from the attenuator is the "threshold of hearing" for the frequency 1024 cycles. This procedure is carried out for each test frequency on the audiometer. The thresholds on the higher frequencies are established first, then for the lower frequencies, starting with 512 cycles. These thresholds are graphed and the chart obtained is termed an audiogram.

For certain diagnostic purposes a bone conduction test may be indicated. At the present time, however, testing of bone conduction by means of an audiometer is not standardized. Bone conduction oscillators vary to such an extent that it is necessary to establish the average normal threshold for each test instrument. A properly calibrated masking noise to eliminate the hearing of one ear while testing that of the other should be used on all bone conduction tests and for air conduction tests when there is a disparity of 30 decibels or more between the thresholds of the two ears. In these cases an accurate test on the poorer ear can be made only by masking out the hearing of the better ear. Malingering tests, such as the Stenger or Lombard test, should be done if simulated deafness is suspected.

Speech reception test

The speech reception test is now an accepted means for determining an individual's ability to hear and understand speech, and for hearing-aid evaluation. It can be given with a loud speaker or an ear-

phone. Either bilateral or unilateral hearing may be tested, in quiet or in the presence of noise, with or without a hearing aid. The test may employ monitored spoken voice, termed "live voice," or recorded voice and the test material may include all types of speech. The speech reception test is absolutely essential in order to fit a hearing aid adequately.

The basic electro-acoustic apparatus necessary for the test consists of an amplifier, power supply, microphone, decibel meter, loud speaker, and receiver. If recorded speech is used, a constant-speed turntable is required. This apparatus must be set up under controlled noise conditions. The unit now in operation at Philadelphia has been carefully installed in sound-proofed rooms, and the apparatus accurately calibrated by means of a sound-level meter. Two rooms are used, one a sound-deadened room in which the patient is seated, the other a quiet booth for the technician. With the exception of the loud speaker and receiver, all apparatus is housed in the quiet booth. There is a communicating system between testing room and control room.

The patient is seated at a fixed distance from the loud speaker. The operator controls the input intensity of his speech by maintaining the decibel or volume unit meter at a constant level, and the intensity of the speech which reaches the patient in the testing room is varied by adjusting the attenuator. The intensity of speech may be changed in one-decibel steps over a range of 100 decibels without overloading the equipment. High-fidelity equipment is required and unless the system is properly calibrated the results will be inaccurate.

Speech is presented first at an intensity which can be readily understood by the patient, who repeats what he hears. The loudness of the speech is then gradually reduced until his threshold is established. This threshold figure represents the individual's speech reception level. The test is accurate to one or two decibels, and so long as the speech is properly monitored by means of the decibel meter, it makes no appreciable difference whether the voice is that of a man or woman. Experience with the use of the speech reception test in our work has been very gratifying. The patients immediately recognize the value of the test, are eager to check the performance of their hearing aids and, in some cases of extreme hearing loss, receive their first ray of hope when they hear and clearly understand spoken voice through the amplifying system of the speech reception apparatus. The first step in their adjustment to the use of a hearing aid has thus been accomplished.

Hearing aids

There are three basic types of hearing aid; namely, the speaking tube or trumpet, the carbon aid, and the modern vacuum-tube instru-

ment. The vacuum-tube instruments so far surpass the older type instruments in performance that they are used exclusively in the Naval program. Modern vacuum-tube hearing aids are fairly uniform in construction and design, the principal differences being in size, weight, appearance and electro-acoustic properties. The essential parts, all miniature, consist of a microphone, an amplifier with two, three or four midget vacuum-tubes, condensers, resistances, volume and tone controls, and a receiver attached to an earpiece or to an oscillator in the case of a bone-conduction instrument. Two batteries are required to activate the hearing aid; an A battery of $1\frac{1}{2}$ volts and a B battery of voltage ranging from $22\frac{1}{2}$ to 45 volts depending upon the type and power of the instrument. The electro-acoustic properties of the instruments may be varied by changing the relationship of the fundamental parts. Selective emphasis of different frequency bands may be obtained by means of a tone control, or the instrument may be constructed with fixed characteristics. There is a difference in the tonal quality of the instruments of different companies.

Hearing aids of nine different companies have been used in this program. Some of these companies have a wide range of instruments with fixed characteristics, others have one or more models with a tone control to change the characteristics of the instruments. Some transmitters are designed for only one receiver, others to be used with as many as five different receivers. The B battery may be $22\frac{1}{2}$, 33, or 45 volts and on some instruments a 30-volt battery is used. The total number of different combinations possible with the testing aids used in this hospital is over a thousand.

Minimum acceptable standards for performance and acoustic properties, such as amount and range of amplification and durability, have been set up by the Committee of Consultants on Audiometers and Hearing Aids of the Council on Physical Medicine of the American Medical Association. Only hearing aids which meet these standards carry the approval of the American Medical Association. Various other groups with properly equipped laboratories such as the National Research Council and the Army and Navy Rehabilitation Centers have been testing the performance of hearing aids and experimenting, with a view to developing improvements. The near future will see further refinements in hearing aids and in the methods for fitting them, the direct results of the knowledge gained in these laboratories.

The earpiece

A properly fitting, comfortable earpiece is essential for satisfactory performance of an air conduction hearing aid. Tests have

proved that the so-called "universal" earpiece may lessen the efficiency of a hearing aid by as much as 20 decibels. These universal earpieces may also cause serious irritation of the external canal. The importance of the earpiece cannot be overemphasized and only by means of an individual ear impression can a suitable earpiece be fabricated. This impression may be made with plaster of paris or with one of the newer acrylic materials.

The prosthetic laboratory in this hospital has produced extremely well fitting earpieces rapidly and efficiently, using the formulas and technics of a local firm. Briefly, the technic of taking the impression and making the earpiece is as follows:

The auricle and canal are lubricated with liquid petrolatum. The impression material is mixed in a jar, allowed to stand for about 3 minutes, kneaded in the hands (which have been properly lubricated) for about 30 seconds to insure good consistency, then inserted well into the external canal. Certain technical details must be observed to insure a proper impression of the ear. The semiplasticized material may be removed in 10 minutes.

The technic of making the actual earpiece from this impression is much more complicated, requiring a special laboratory and highly trained prosthetic technicians. This hospital has such a laboratory and in consequence it has been possible to assure each hearing-aid user of a comfortable, efficient earpiece. (See pages 226-231.)

Hearing aid fitting

Certain pertinent information must be at hand for intelligent hearing-aid fitting. A thorough knowledge of hearing-aid characteristics, such as emphasis of high or low frequency ranges, amount of amplification, types of receivers and batteries, is essential. The patient must be carefully studied. Pertinent medical information includes diagnosis and cause of deafness, duration, condition of the tympanic membranes, presence or absence of vertigo or headaches, amount of exposure to noise, familial history and past history. Data in regard to the extent and type of the hearing loss are obtained by thorough testing. Information of a psychologic nature, such as the patient's attitude toward the use of a hearing aid and his tolerance to noise is essential. No two patients are exactly alike and they must be treated individually. Great emphasis has been put on this point in the Navy rehabilitation program and each member of the staff is well versed in the psychology of dealing with the hard-of-hearing person.

Much has been written about fitting a hearing aid to an audiogram. This is sometimes spoken of as "selective amplification" or

"mirroring." In theory it would seem to be the ideal procedure but experience has shown that this method alone does not bring the best results. The explanation is fairly simple. The acoustic properties of a hearing aid may be modified by a number of factors directly attributable to the patient, such as body baffle effect. The instruments do not amplify all frequencies an equal amount but have peak amplification at some point or points in the speech frequency range. These peaks vary with different instruments. The standard audiometer has test frequencies only at octave intervals; consequently it is necessary to assume that the thresholds for the frequencies between the octaves lie along the charted line. Though the characteristic curve of an instrument may mirror the audiogram chart, this may not occur when the hearing aid is worn by the patient. Furthermore if the patient has had a hearing loss for some length of time he will have developed an abnormal speech-hearing pattern. This cannot be corrected by merely amplifying the audiometric frequencies an amount equal to his degree of hearing loss, even if this were possible electro-acoustically.

However the audiogram gives essential information from a diagnostic point of view. It presents a picture of the amount of the hearing loss, whether the loss is in the low or high frequencies or is the same for all frequencies, the three major categories of hearing loss. The hearing aids are grouped into minimum-gain, moderate-gain, and maximum-gain instruments and the test aids for the individual cases are selected from the appropriate group. Frequency emphasis suitable for the type of hearing loss is selected in a similar manner. Because of the large number of possible combinations, a satisfactory hearing aid can be found for almost every type of hearing loss.

Controversy has arisen over the use of air- or bone-conduction hearing aids. Our experience has proved that bone-conduction hearing aids are less efficient than air-conduction aids and the majority of patients obtain far better reception with the air-conduction instrument. This is true even with the patients whose functional tests show bone conduction to be greater than air conduction. Two factors obtain here; more power is required to activate a bone-conduction oscillator than is needed for an air-conduction receiver, and the air-conduction receiver is far more efficient in amplifying the higher frequencies so important to speech intelligibility.

There are, however, two types of hearing loss for which a bone-conduction aid may be preferable: (1) The case with perforated tympanic membranes and suppuration (provided the hearing loss is not greater than 60 decibels in the speech frequency range); and (2) the case with a moderate loss of hearing due to impairment in the

conductive mechanism of the ear. In our series of over 2,200 patients fitted with hearing aids only 65 bone-conduction instruments have been recommended.

Selection of the ear on which to use the hearing aid remains a controversial topic. The following rules of procedure have been adopted here, and the results attest their reliability. If there is an average moderate loss in both ears and the patient can still use the telephone satisfactorily, the ear not used in telephoning is fitted. If there is a disparity between the ears, for example, an average loss in the better ear of 40 to 50 decibels and a loss of 70 or more decibels in the poorer ear, the ear with the better hearing is selected. The reason for this is that it would be necessary to use a powerful aid on the poorer ear to obtain the required gain of more than the 30 decibels difference between the two ears, and unless this is accomplished the patient still has a handicapping hearing loss. For the same reason the hearing aid should be worn on the ear with the better hearing in cases of more extensive loss. There are, of course, exceptions to these rules and special cases must be handled according to their needs.

In this hospital the actual fitting of the hearing aid is carried out approximately one week following admission. By this time the patient has become adjusted to the rehabilitation program. He has had several classes in speech reading and in auditory training, where he has used a group hearing aid. This work with the group hearing aid is of great value in preparing the patient for the selection of his own aid. His tolerance for noise is usually improved and he has become acquainted with amplified sound.

Preliminary screening tests are conducted in a room with an average noise level. Here the patient sits at ease and uses hearing aids which have been selected by the technician for their suitability to his type of hearing loss. The fit of his own earpiece is checked at this time. No limit is placed on the number of aids tried on each patient, but the aid finally recommended must meet several criteria. It must produce a gain of 30 decibels or more in speech reception; it must be satisfactory to the patient in terms of tonal quality and of performance in noise; and the amplification of the patient's own voice must be acceptable. The patient's satisfaction with the physical and acoustic properties of the aid is a major factor in his final adjustment. Comparative speech reception tests are conducted both in a quiet environment and in the presence of noise with the aids preferred by the patient; this provides additional data for selection. The aid which produces optimal results is delivered to the patient and he is given initial instruction in its use. Detailed instruction is continued in the auditory training department during

the remainder of the rehabilitation period. He is given specific training and tests, and is urged to express his likes and dislikes. If for some reason a change is indicated in the hearing aid selected, an adjustment can be made.

Discussion

The selection and fitting of hearing aids is a complex operation that requires excellent equipment and experienced personnel. So far as the needs of the hard-of-hearing person are concerned, it makes no difference whether he be civilian or serviceman. With exception of the work done in a very few otologic laboratories, however, civilian methods of hearing-aid fitting have been quite inadequate. In a survey published in 1940, Day¹ stated that 75 percent of all hearing aids purchased were eventually discarded. In contrast, a survey made in 1943 by Hughson and the present writer² showed that of a group whose gain with a hearing aid was quantified by thorough speech reception tests, 80 percent were satisfied. Moreover a recent survey of patients fitted with hearing aids in this hospital indicated that 94 percent were continuing to use their aids. Granted that recent improvements in hearing aids are partially responsible for better performance, and thus the satisfaction of the wearers, it is apparent that the very best in term of equipment and trained personnel is necessary for optimal results.

SUMMARY AND CONCLUSIONS

There has been presented a description of the methods employed in the selection and fitting of hearing aids in the Acoustic Laboratory. Speech and Hearing Rehabilitation Unit, U. S. Naval Hospital. Philadelphia. Recent scientific developments in the field of electro-acoustic equipment have made possible accurate testing of hearing by means of the audiometer and the speech reception apparatus. The nature of the testing procedures is outlined and discussed. At the present writing, 2,216 patients have been fitted with hearing aids, of whom 94 percent continue to wear their aids with satisfaction. Modern vacuum-tube instruments are more efficient than carbon instruments, consequently only vacuum-tube hearing aids have been recommended for these patients. The great majority of the hard-of-hearing can be fitted with a serviceable hearing aid. Only 6 out of the total number of patients tested were so deafened that they could not benefit from the use of a hearing aid. Air-conduction hearing aids are more efficient than bone-conduction instruments except in cases with bilat-

¹ Day, K.M.: Prescribing a hearing aid. *Pennsylvania M. J.* 43:1299-1302, June 1940.

² Hughson, W., and Thompson, E.: Hearing aid from the patient's point of view. *Arch. Otolaryng.* 38:252-260, September 1943.

eral suppurative otitis media with perforated tympanic membranes or cases with a moderate loss of hearing, due to impairment in the conductive mechanism of the ear. Of the hearing aids recommended only 65 were of the bone-conduction type. It is apparent that the complex process of selecting and fitting a hearing aid appropriate to the individual's needs is an essential element in the rehabilitation of deafened service personnel.

VII. FABRICATION OF EAR MOLDS

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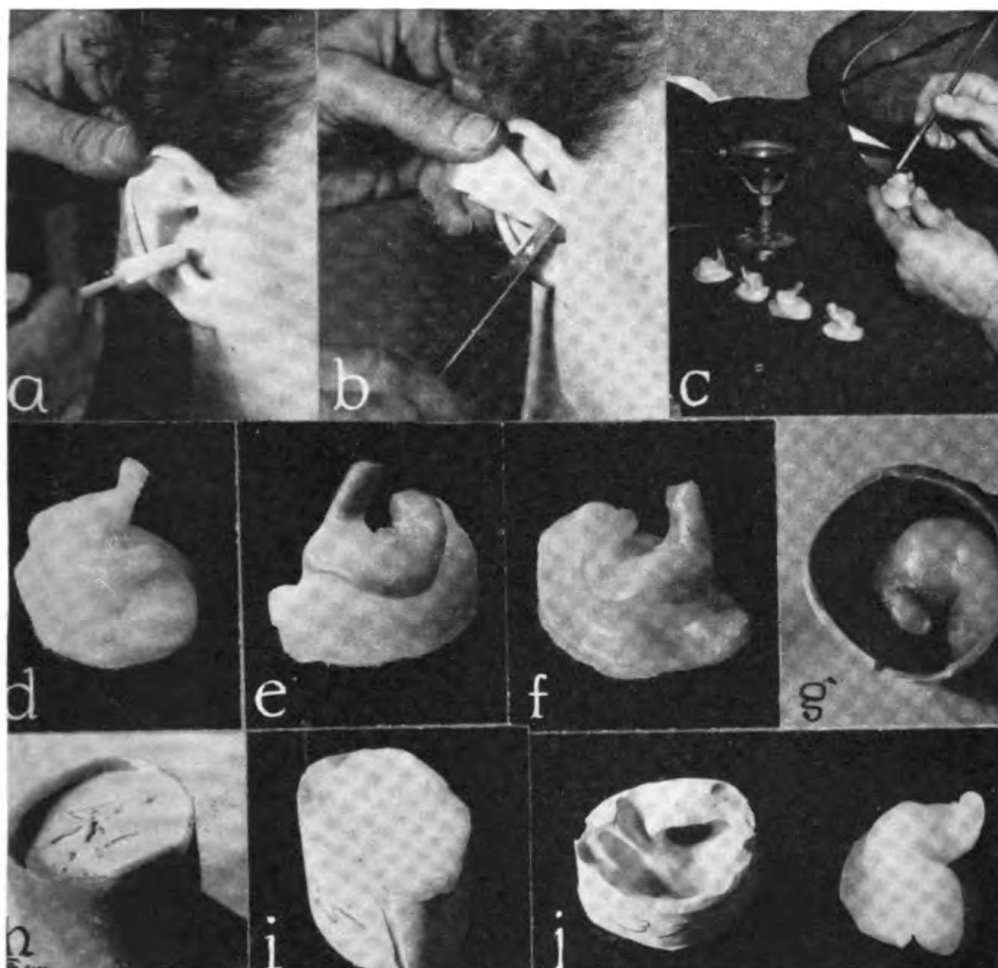
An important element in the satisfactory performance of a hearing aid centers in the adequacy of the ear mold. It has been determined in the acoustic laboratory of this hospital that the so-called "universal" ear molds often used may lessen the efficiency of an aid by as much as 20 decibels. Nor can too much emphasis be placed upon the care with which the ear mold is tailored; the task requires the utmost precision.

Ear molds for use in the aural rehabilitation program were at first produced by a local commercial firm. Exigencies of time and patient-load, however, soon demonstrated that this practice was inefficient and our own laboratory was equipped in March 1945 to supply the needs of the aural rehabilitation unit. There follows a description of the fabrication of ear molds from a methyl methacrylate resin, according to the methods employed here in the production of approximately 1,500 such plastic pieces.

Procedure

The patient reports early in the morning for an impression of the selected ear. The auricle and canal are lubricated with liquid petrolatum, or a similar oil, to facilitate the removal of the impression material (fig. 1a). Using a clean 2-ounce jar, the technician adds 6 cc. of monomer to 18 cc. of polymer and allows the mixture to stand for about 3 minutes without artificial agitation. Before removing the viscous mass from the jar, the technician lubricates his hands thoroughly.

He kneads the material for about 30 seconds to insure proper consistency, then elongates one end and inserts it well into the external canal (fig. 1b). To insure optimum depth, the concha should be pulled up and back and an instrument used to pack the material firmly into the canal without undue displacement of the tissue. The semiplasticized material may be removed in about 10 minutes, examined to check results and, if found satisfactory, numbered for identification.



1. The fabrication of ear molds. **a.** Ear lubricated. **b.** Material packed in. **c.** Molten wax applied. **d.** Periphery trimmed. **e.** Irregularities corrected. **f.** Molten wax applied. **g.** Wax boxing applied. **h.** Gypsum poured. **i.** Wax boxing removed. **j.** Impression removed.

The first step in preparing the impression is the removal of excess from its periphery (fig. 1d); the intruding section of the prosthesis is best limited to about $\frac{1}{2}$ inch measured from the external auditory meatus. Concavities and distortions at principal pressure-points are corrected by the application of wax (fig. 1e). A thin coat of molten wax is then applied to the whole impression with a camel's hair brush; this will compensate for losses during the finishing process. Strips of wax, $1\frac{1}{2}$ inches by 7 inches, are then used to box the coated impression, and made to adhere by flowing hot wax over the areas where union is desired (fig. 1g). The boxed impression is then chilled by immersion in cold water.

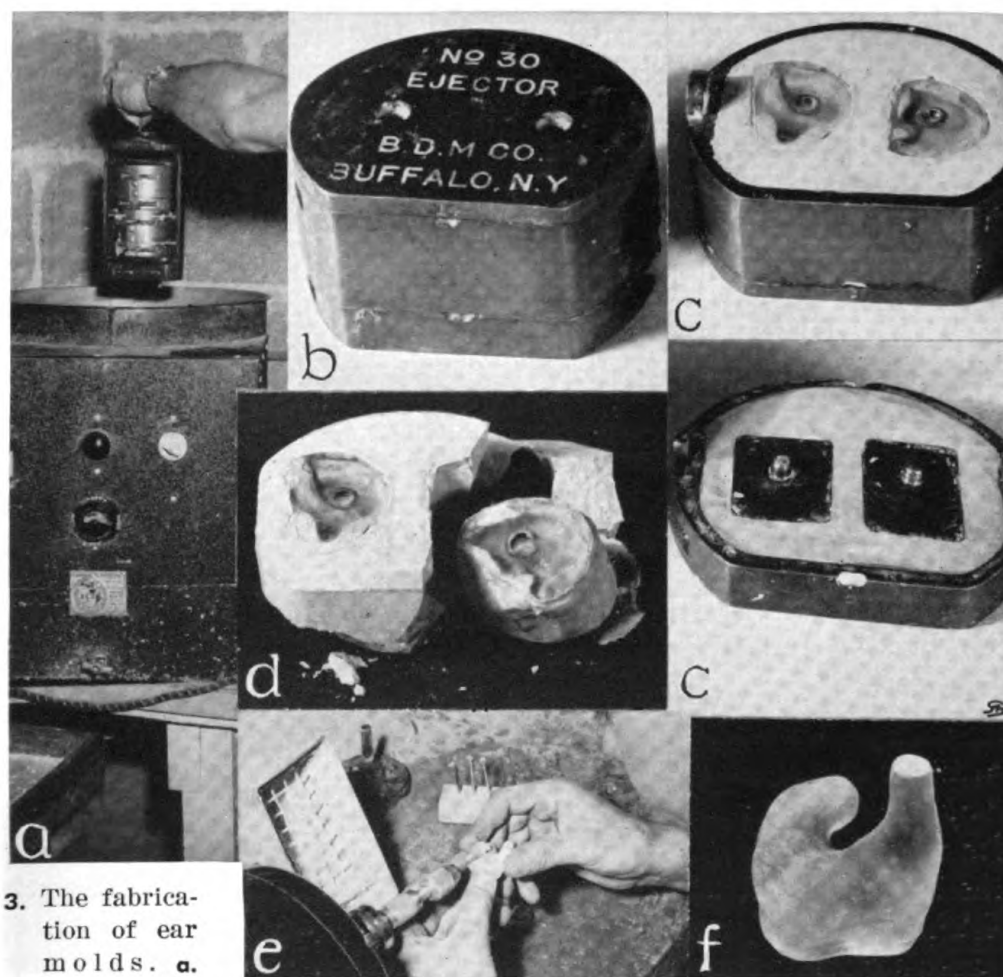
A moderately thin mix of artificial stone and plaster of paris is then prepared; this develops a creamy texture when agitated to eliminate trapped air. The gypsum is then poured carefully into the

boxed impression until the tip of the canal is completely covered (fig. 1h). When the substance sets and hardens, the wax boxing strips are removed (fig. 1i), and the number of the impression is transferred to the base of the cast. The impression is then removed, care being taken to avoid destruction of the essential anatomy, and the remaining wax is picked out of the cast (fig. 1j).

The number is stamped on the two remaining sides, and the base and buccal aspects of the cast are beveled slightly with a sharp knife. The cast is plugged with a wad of wax which is trimmed flush; into this is placed a brass plate, 2 inches by $1\frac{1}{4}$ inches by $\frac{3}{16}$ inch (fig. 2a). The off-center pin which extends $\frac{1}{8}$ inch on either side of the plate is pressed into the wax and the plate is secured by plugging the apertures with wax and flowing molten wax around the edges. The cast is held plate downward and placed in the lower half of a No. 30 ejector-type dental flask; such a flask accommodates two casts (fig. 2b). The excess plaster is trimmed away so that a smooth floor is obtained. When the material sets, it is painted with a separating medium of sodium silicate and allowed to dry.



2. The fabrication of ear molds. a. Brass plate applied. b. Lower half invested. c. Upper half invested. d. Case opened, wax removed. e. Case washed out. f. Material packed. g. Flasks in compensating spring press.



3. The fabrication of ear molds. a. Press in plasticure. b. Cured flask removed. c. Cured flask opened. d. Mold removed from gypsum. e. Mold being finished. f. Mold finished.

The coated surface is then saturated with cold water, and the top half of the flask is filled with a mixture of artificial stone and plaster in the same proportions used initially. In approximately fifteen minutes (when the flask is warm to the touch) the two halves are separated, the wax plug is removed, and all wax residue is removed with clean boiling water (fig. 2d, e).

The acrylic is then prepared by adding 6.26 cc. of monomer to 25 cc. of polymer in a 2-ounce jar; this is allowed to set for about 4 minutes, after which the material is tested for total saturation and adhesion. The jar is then covered to aid even polymerization and in approximately 12 minutes the rubber-like mass may be removed from the jar. Unless it can be removed in one piece, the acrylic has not been polymerized sufficiently and should not be used. When the material has reached the proper consistency, it is tested by the technician who holds the mass in his fingers and pulls it apart. There should be a clean, sharp break, not a taffy-like separation.

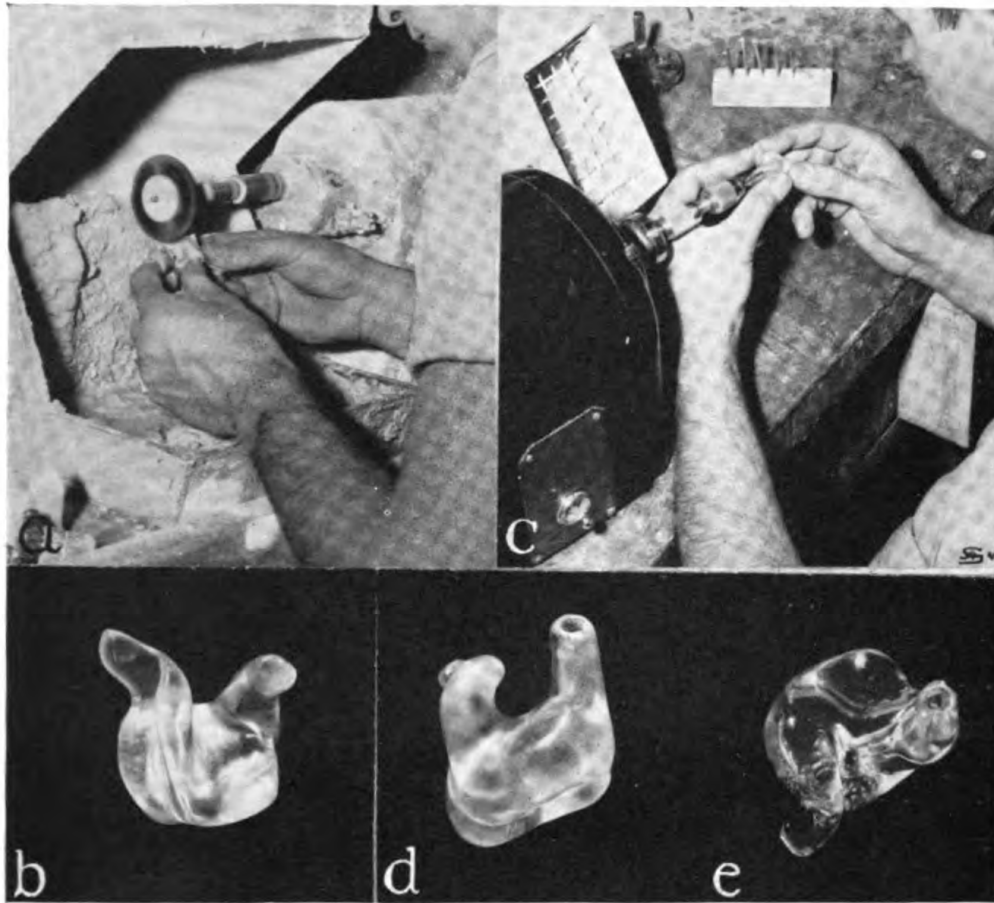
The acrylic is then kneaded to a fine taper and inserted well into the canal, then tamped with a clean, blunt instrument to eliminate trapped air. The cavity is filled with the remaining material (fig. 2f). One sheet of damp cellophane is placed over the material, then the two halves of the flask are brought together and pressed slowly in a dental bench-press. When the two halves of the flask have made contact, the flask is removed from the press and the two parts separated. This is known as a test pack. The cellophane is then removed, excess material cleaned from the flask, and a small ball of acrylic is placed in the center of the mold over the pin depression. Specially designed brass rings are placed on the exposed plate-pins on the opposite half of the flask. The two halves are again brought together and pressed slowly until optimum closure is achieved. The flask is then transferred to a compensating spring-press and closed (fig. 2g).

The unit is submerged in a thermal bath and cured for 4 hours in water, the temperature of which is maintained at 160° F. (fig. 3a). The cases are then removed from the thermal bath, chilled to room temperature and opened (fig. 3b, c). Molds and casts should be dug out undamaged, the rough edges trimmed away, and identifying numbers transferred to the mold close to the brass ring. The cast may then be removed by sawing sections, or by tapping with a blunt instrument, using quick, sharp blows. With the mold in full view, the technician can eliminate more excess with a 2-inch heatless stone.

The finishing process consists simply of "skinning" the cast, or removing its powder-like film with a barrel-shaped dental bur (fig. 3e); a No. 10 dental bur may be used where there are undercuts and minute crevices. The mold is then finished with a Dixon one-row brush, and the broad, flat surfaces are polished with a wet-rag wheel (fig. 4a, b). When all the scratches have been removed, a canal is created to conduct sound waves. For this are used a $\frac{1}{16}$ -inch drill, a $\frac{3}{32}$ -inch drill, and a No. 10 dental bur (fig. 4c, d).

Proper drilling is an exceedingly delicate process, and great care must be taken to avoid piercing the wall of the mold. The first bore is made in the flat surface of the mold and extends to the point of angle of the intruding section; then the mold is rotated, and the second bore is made through the intruding section to a juncture with the first bore. The mold is then given a high luster with the use of a dry-rag wheel and any suitable high-shine medium. The finished case is coated with liquid petrolatum, dried with soft gauze, and is ready for delivery to the patient (fig. 4e).

The patient wears his own ear mold during the evaluation and selection of his hearing aid. Later, when his aid is in daily use, the instructors in auditory training check on the efficiency and comfort



4. The fabrication of ear molds. a. Mold being polished. b. Polished mold. c. Mold being drilled. d. Mold drilled. e. Completed mold.

of the ear mold in actual operation, and any necessary modifications to relieve pressure are made immediately.

It is believed that the method of producing acrylic ear molds described here represent maximal efficiency in precision work. Employing this method, 4 trained technicians can make as many as 30 ear molds within a 24-hour period, more than sufficient to supply the needs of an extensive program of aural rehabilitation.

SUMMARY

Our experience at the U. S. Naval Hospital, Philadelphia, in the production of more than 1,500 acrylic ear molds for use with hearing aids has led us to make every effort to insure the proper individual fit of each ear mold. With such an attachment for the hearing aid, the deafened person may receive the benefit of as much as 20 decibels of sound-pressure more than if he were to use a "universal" ear mold. The procedures for taking an impression of the patient's ear and for fabricating the ear mold from a methyl methacrylate resin are described in detail.

VIII. SPEECH READING, AUDITORY TRAINING AND SPEECH CORRECTION IN THE RE-EDUCATION PROGRAM

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The goal of the program of hearing and speech rehabilitation at the U. S. Naval Hospital, Philadelphia, is so to recondition Naval personnel with aural disabilities that they may once again lead normal, socially and economically sufficient lives. Implicit in this task is the need to retrain the individual's communicative habits so that he may achieve maximal success in getting along in a world of sound. The pattern of the re-education course developed here has incorporated much of traditional methodology in work with the deafened, rearranged certain aspects of the familiar into new designs, and pioneered extensively in an effort to meet urgent needs with speed and dispatch. Specific instruction and clinical service in terms of speech reading, auditory training, and speech correction constitute the re-education program.

This program is described and certain aspects which entail fresh approaches to the problems of communication by the hard-of-hearing are discussed in some detail, in the light of our experiences with nearly 3,000 hard-of-hearing individuals.

PHILOSOPHY OF THE RE-EDUCATION PROGRAM

Whatever else he is, man is a social person whose every detail of daily thought and action is intimately connected with his habits of communication. Speaking and hearing, the two elements of the communicative process, cannot logically be separated; it is an inter-related process. Any serious impairment in either of these elements results in a breakdown of the machinery of human relations. If one cannot freely exchange ideas through the spoken word, there are profound psychologic and sociologic effects. The more marked the hearing loss, the greater the isolation that is imposed upon the indi-

vidual. Moreover, since the majority of hearing losses among Naval personnel are relatively recent, it is sensible to get at the problem of repair while the individual's speech habits are still normal; it has been amply demonstrated that speech deterioration may set in all too soon after the onset of a hearing loss.

The learning, the perceiving and the production of language is a closely interrelated series of auditory, visual and kinesthetic stimuli and motor-responses. Inasmuch as language is learned chiefly through the ear, hearing remains the most natural means to understand it. In fact the auditory sense is so predominant that the average person is quite unaware that other senses do or can supplement his understanding. Therefore whenever the hearing is even slightly impaired, it is important that the individual be trained to utilize all visual, kinesthetic and situational cues to reinforce the faulty auditory pattern. In our program this training is centered in two closely correlated courses.

Speech reading, sometimes called lip reading, relates to the deafened person's ability to use visual and muscular cues to enhance or, in cases of profound hearing loss, to supplant normal auditory percepts. *Auditory training* refers to the re-educational process of helping a deafened person to use his residual hearing supplemented by a hearing aid. These two courses, together with a special program of group therapy and whatever special work in speech training is individually indicated, constitute the extent of our re-education program.

SCOPE OF THE RE-EDUCATION PROGRAM

The degree, type and duration of hearing loss and the prognosis for each patient control the emphasis put upon each of these elements in the retraining program. In general terms the work is designed for a period of 4 weeks, with class-time scheduled for 5 hours weekly in each of the two basic courses. This schedule is open to modification, however, according to demonstrated individual needs. In the past, we have operated with a 7- to 8-week course, meeting three times each week; the over-all period was shortened to meet the exigencies of patient loads. We frankly admit that a 4- to 8-week training period implicates maximal performance in terms of the learning span for the skills of speech reading and for tolerance adjustment to a hearing aid, and that the present foreshortened training period has been a military necessity and is probably not ideal.

A person with a profound hearing loss will inevitably be heavily dependent upon speech reading, and will require more skill than the man with a medium loss whose hearing aid gives him fairly adequate sound perception. The patient with a slight loss needs relatively little work with residual hearing, once he has learned to use

his aid efficiently; while the man with a moderately severe loss needs a thorough re-education in the identification and interpretation of sound stimuli under a variety of circumstances. Every patient receives work in speech training as part of the content of the two major courses, and special remedial attention is provided according to whatever individual defects or disorders require treatment.

Whether to fit a hearing aid early in the process of re-education for the person with a hearing loss is a familiar question. Some specialists hold that if a man wears an aid he will not exert the necessary effort to gain proficiency in speech reading. We have determined, however, that every person who can profit from the use of an aid should wear one as soon as possible. He gains confidence from his ability to hear more clearly; interviews with staff members are made easier and more effective; he can understand classroom directions; he can take a more active part immediately in social life. Fortunately only 6 of 2,787 patients handled here have had so little residual hearing as to find a hearing aid useless. And even those with a profound loss, typically perceiving only 2 or 3 measurable frequencies in both ears, profit greatly from the amplification furnished by an aid; they can usually distinguish some speech sounds and are thus helped to fill in the visual gaps of speech reading; and, equally important, receive sound cues as vibrations which direct their attention to activities around them.

SPEECH READING

Problems of a speech reader

Speech reading is at best a complex process. Every conversational situation includes many factors beyond the speech reader's control. Moreover the conversation may be so complicated by poor speech, poor lighting and extraneous confusion that even the most expert speech reader is at a disadvantage. The ideas presented must be grasped in a fleeting instant, for speech is movement. Only about a third of speech movements are visible, and none are static; the whole process is an ever-changing continuum. To these variables must be added the facts that there are no two mouths alike, nor two people who talk in the same way. Consequently the speech reader must see speech as a whole, not attempting to analyze what he sees, or he will labor painfully to frustration. He must be interested in events and want to know what is going on. He must be alert to anticipate every turn of conversation, yet avoid undue tension. He must concentrate on what he sees, piecing together every clue that may lend meaning. Above all, he must keep a sense of humor through many baffling defeats.

Principles of speech reading

In the 18 months since its inception the speech reading program here has undergone numerous changes, but throughout there has remained a basic planned pattern. There has been no attempt to follow any particular school of thought; instead every effort has been made to experiment judiciously and adapt techniques and materials to conform to the immediate needs of our patients. Our general approach, however, is closely related to the fundamental principles of the Jena method, which invites close correlation among speech, speech reading and auditory training by utilizing all sensorimotor channels. Our approach is built upon the thesis that speech has various forms; the audible, the visible, and the kinesthetic or "feeling." Of these the kinesthetic is the only one that is complete for everybody under all circumstances; a hearing loss affects audibility and visible cues are insufficient. For this reason we emphasize the "feeling" of speech, together with what audible and visible cues are available; patients are taught to feel, hear and see simultaneously. They are taught to recognize some of the other cues that are associated with a typical speech situation; gestures, facial expression, objects handled or referred to, the place and the personality of the speaker. All these elements of communication serve to supplement the experience of seeing, hearing and feeling.

The speech reading program

Every patient is required to take a concentrated speech reading course that is adapted to his needs. It consists of twenty basic lessons of an hour's duration supplemented by special classes to provide additional practice. Instruction is given in small homogeneous groups of five to eight patients. This grouping is conducive to optimum learning if the students are well graded. A screening test to facilitate such grading is given each man upon admission.

Classes are held in small rooms, preferably with the students seated comfortably in a semicircle so as to provide the opportunity to observe any member of the group who may be talking. It encourages a relaxed, easy, conversational atmosphere, a factor that has been found of immeasurable value.

Each classroom is equipped with a small sound-treated, well-lighted booth with a large glass partition that separates it from the rest of the room. This device provides valuable "silent practice" in which no auditory cues can be heard, and so demonstrates that the student can follow a conversation, if need be, without such help. The speaker sits in the booth and talks in a normal conversational voice eliminating any tendency to exaggerate or distort the speech pattern. Charac-

teristic gestures and facial expressions are freely employed as no brief is held for abnormal "dead-pan" speech. The use of the booth serves to focus attention, making it easier to concentrate on the speaker.

Each classroom is equipped with a group hearing aid and it is possible to sit in the booth and hold a two-way conversation. The use of amplified sound greatly facilitates explanations and instructions and establishes confidence in the learning situation. Some interesting experimental work has been done by gradually decreasing the intensity of the speech, so that the class members do not realize when they are speech reading or when they are using a combination of hearing and seeing.

The instructor assumes the responsibility for cognizance of the needs and the progress of every individual student in the class, supervises his entire course and makes whatever modifications are advisable. In 4 weeks are covered the basic lessons designed to build essential skills. In order to provide additional practice and to insure experience with the speech habits of various persons, attendance at special advanced drill classes is required. This work is usually started about the second week of instruction.

Exceptionally good or particularly slow speech readers may be changed, upon the discretion of the teacher, to a more equable group. Other students may require some individual instruction in addition to class work to insure satisfactory progress.

At the end of the fourth week a proficiency test is administered to evaluate each man's progress. To have passed this test is one of the prerequisites for appearing before the board of medical survey. The proficiency test is a written examination designed to measure a speech reader's ability to follow representative types of material. Failure means additional instruction and retest at a later date.

It has been our experience that adults learn more quickly and apply themselves more diligently if they understand the purpose and significance of the whole process. Over-all aims are outlined and technics and procedures explained so that each student has a clear concept of the problems involved in speech reading.

A good device to challenge interest and lead the student into an awareness of speech is to present a simple explanation of English phonetics. This study serves as a common foundation for all three phases of the speech and hearing retraining. By rapid analysis of English sounds the student is led to appreciate how speech is articulated and to associate the auditory, visual, and kinesthetic cues.

Initially a part of each lesson is devoted to the so-called imitation exercises. This is particularly useful with slow groups. The student talks simultaneously with a leader so that he hears, sees, and feels

the speech pattern. This is immediately followed by a silent review of the same material spoken by the leader while the student watches and endeavors to recall all the sensations he had while talking aloud with the speaker. In short, motor impulses related to speech are built up in response to visual cues related to speech.

To develop this, syllable drills and simple word series are used which foster a "psychologic set," such as counting, enumerating the days of the week, colors, and the like. Gradually the material increases in difficulty as more complicated grammatical forms are added. These drills are presented in such a way as to make the subject aware of and responsive to the rhythm and flow of language and to gain an appreciation of stress and accent. These "talking-together" exercises have the additional value of improving voice and articulation.

Each lesson is organized around a central theme. Besides the advantage of giving unity and point to the lesson, this is of great help to the student by giving him some indication of what to anticipate. In the basic series, everyday experiences determine the selected topics, such as the hospital, the restaurant, a bank, shopping and so forth. Each unit is carefully planned to utilize a common vocabulary and to use a simple conversational style. A wide variety of material has been collected about each theme and rewritten on various levels of difficulty for classes of different abilities. Skits are acted out by members of the group to develop powers of observation as well as to train the class to follow rapid dialogue.

The topics selected for the more advanced units depend largely upon the interests of each particular group, for interest in the subject under consideration has been found of vital importance. As the student progresses, stress is placed on developing greater skill in more difficult situations with a greater variety of speakers.

Still further practice situations are set up for the more advanced students to enable them to test their skill in communicative situations they will encounter in everyday life, such as lectures and group discussions. This is not done as silent practice, but under the same conditions that must be faced upon discharge from the hospital. Well-acted movie scenes that have been specially prepared, or carefully selected "cuts" of long commercial movies provide valuable additional practice.

COMMENT

At present 2,787 men have been processed in the Aural Rehabilitation Unit. This wide cross-section of adult American population has furnished ample means to study typical and atypical hearing

cases in reference to speech reading. This experience has enabled us to evaluate our results and arrive at some pertinent conclusions.

1. Small homogeneous groups are preferable to individual instruction. Providing healthy competition and the stimulation of many minds, group instruction makes for more interesting lessons. It offers encouragement to the student for he soon sees his problem and difficulties are not unique and he profits by the readjustment and philosophy of his classmates. It also permits him to compare his progress with others and allows for the subtle satisfaction of minor triumphs before a group. It provides a relaxed atmosphere with the easy give and take that is highly conducive to good learning. A group that is small enough for a teacher to know each student, yet large enough to permit a variety of procedures, offers greater challenge to both teacher and student. In addition it is more economic of time, energy, and money, inasmuch as a greater number of students can be taught with the same staff and classroom facilities.

2. A primary requisite for learning is interest in the topic. The use of life-situations that involve living dynamic language has been found best. This gives practice with the vocabulary, idiom, and phraseology that confront the speech readers outside the classroom; it allows great flexibility and full play of the individuality and imagination of both pupil and teacher; and by encouraging group participation it breaks down the feeling of isolation that haunts every deafened individual.

3. Short, frequent class periods provide the best learning situation. By centering the patient's entire attention upon gaining skills to overcome his handicap, rapid progress is made. Classes should never last longer than an hour.

4. The necessity for a teaching staff qualified by thorough training in the whole process of oral communication has been amply demonstrated. Such qualifications are essential if a well-integrated program is to be carried out. This implies that each teacher have a normal voice and good articulation. It is advisable that the instructor have good hearing so as to be able to correct any speech faults in the students.

5. One of the greatest needs in the field of speech reading is experimental evidence to determine what makes a good speech reader. Standardized diagnostic tests should be constructed. On the basis of this research, a teacher could then analyze the needs of a student and proceed accordingly. Then, too, there is need for well-graded and standardized achievement tests to measure progress objectively. The tests that have been constructed and used in the Naval program are a step in the right direction.

AUDITORY TRAINING

Development of the course

At the outset our work in auditory training was frankly experimental; there was little precedent to follow and the precise nature of the psycho-physiologic problems involved was relatively undetermined. Every otologist is only too well acquainted with the casual, often haphazard way in which hearing aids are delivered and explained to the wearer. Fortunate, indeed, is the person who receives more than 20 minutes' worth of advice and suggestion from the salesman. There need be little wonder at the difficulty and discouragement felt by the average hard-of-hearing person who faces, without advice, the problems of sound discrimination, the acceptance of ambient noise and the adjustment of tolerance, when he attempts to use electronic amplification. In a 12-month period of experiment and adaptation, we have learned a good many lessons about the training of residual hearing with the use of a hearing aid.

Underlying the work in auditory training are two basic principles of rehabilitation, the development of an objective attitude toward one's disability, and training in the means to prevent this disability from becoming a handicap. The first of these implies a competent understanding of aural problems and individual limitations; the deafened person who wants to live a normal life in a world of sound must face his disability squarely and learn everything he can about it. The second principle involves a sufficient opportunity to adjust to amplified sound under expert supervision, and considerable practice in the use of a hearing aid in a wide variety of life-situations.

In order to translate these ideas into concrete classroom procedures, we have divided the work of auditory training into four fundamental categories. Our objectives are (1) to condition the rehabilitee to amplified sound, (2) to instruct him in the care and use of his hearing aid in various situations, (3) to present the foundation for an understanding of functional hearing, and (4) to consider postservice problems relative to social and economic adjustments.

Organization of the course

The men meet in groups of 10 to 12 for an hour 5 times each week. As in speech reading, group instruction in auditory training has proved salutary. Group instruction helps a man to outgrow the negativism of deafness; he learns the difficulties common to all wearers of hearing aids, and he gains a wider understanding of hearing disabilities. Through the interchange of ideas with other members of the group he shares the common ground of difficulties and is encouraged to be experimental.

Every class is homogeneous to the extent that each man has roughly the same degree of hearing loss. Three categories are used in organizing the classes: Group A, 30 to 40 decibels; Group B, 40 to 70 decibels; Group C, more than 70 decibels. No brief is held for these divisional lines; practically they suggest marginal, moderate, and severe hearing losses. Men with profound deafness, beyond the reach of a hearing aid, receive special individual instruction.

The attitudes with which the patients face the prospect of wearing a hearing aid follow no particular pattern. The majority of the men want to hear better and are receptive to the use of an aid. Some, however, associate a hearing aid with old age and an inquisitive public, and prove resentful at every step of their orientation. Most of this group respond rapidly to the ease of strain that comes with their early experiences in the use of an aid. More tenacious are the antipathies of the very young men, who are extremely self-conscious and apt to be vain of their appearance. These are the men who try to get by with a bluff. By and large, the problems of negativistic attitudes are greatest among the patients in the marginal- and medium-loss groups.

Most of those in the marginal group (with a hearing loss of 30 to 40 decibels) experience difficulty in specific situations such as conversations in noisy places, large social gatherings, movies, church and lectures. Those whose hearing loss is recent are especially annoyed by dulled, blurred and limited hearing. They anticipate the normal, and so tend to be hypercritical of what they hear by amplification. Of those whose duration of loss is long-term, many have so far forgotten the refinements of hearing that they consider the improvements of an aid superficial. This group needs considerable reorientation and re-education in auditory habits and standards.

Patients with a medium hearing loss, that is, a depression of 40 to 70 decibels in the speech range, vary in attitudes toward wearing a hearing aid according to their needs and personalities. The majority are sufficiently aware of their handicap to accept amplification readily for most situations. Exceptions are centered in pride in personal appearance and in physical independence, discomfort in listening to amplified sound, and inability to discriminate sounds with clarity. Some who have suffered severe acoustic trauma find their early experience with amplified sound quite uncomfortable; they most need to develop their tolerance-levels. Occasionally a patient with severe tinnitus finds that amplification so aggravates this condition as to hinder auditory intelligibility; he needs to learn concentration on communication to the exclusion of ambient noise. Patients with a long-standing impairment evidence imperfect audi-

tory percepts; they most need to establish more complete auditory patterns.

Least difficulty, so far as attitudes are concerned, is encountered with those in the profound-loss group. They may hear only a few discrete frequencies by audiometric measurement, and their loss in speech reception may be as much as 100 decibels. The ability to hear again, limited though it may be, perhaps amounting to the reception of only a few sound vibrations, is genuinely appreciated by men in this group. They put in many extra hours at the task of learning to interpret the sounds presented by the hearing aid.

THE RETRAINING PROGRAM

Each classroom in auditory training is sound-treated sufficiently to diminish room-noise level and the confusion created by uncontrolled reverberation, and is equipped with multiple hearing aids, a high-fidelity microphone, a record player and an electric tape recorder.

Conditioning the rehabilitee to amplified sound

The initial stage of auditory training is concerned with the patient's ability to listen comfortably to amplified sound. The multiple hearing aid brings the men vocal and instrumental music either directly from the output of a record player or through a loudspeaker-microphonic pick-up that allows the introduction of ambient noise and thus provides fairly normal hearing situations. It is a rewarding experience to watch these men hear easily sounds which many of them have not been able to distinguish for months, some for years. An attempt is made to provide the men with unilateral hearing, using only one earphone, in a fashion consonant with the effect they will get from their own individual aid. As a matter of fact, it has been determined that the appropriate fitting of an individual aid is made much easier by these early listening experiences with the group aid, and the fitting schedule is regulated accordingly. Primarily at stake in these early class sessions is not only the individual's adjustment to electronic amplification but improvement in his tolerance-level, in order that he may later accept the impact of a variety of sounds typical of the normal hearing situation.

The necessity for extensive re-education in auditory intelligibility is dependent upon the degree of hearing loss. Regardless of the amount of loss, however, specific training in intelligibility begins with what the listener can hear easily. Sound discrimination tests are given often during the course to furnish both instructor and rehabilitee with objective data on performance in controlled situations. Some part of each class hour is devoted to training in specific hearing.

For rehabilitees with a profound loss, specific listening may be limited to certain vowel sounds, in rhythm-patterns and in combination with the consonants easiest to hear. These men will probably never distinguish whole conversations, but will employ minimal auditory cues to augment their skill in speech reading. The very profoundly deaf may never use their aids in conversation at all, beyond the point of helping them to control their own voices.

Those with a medium loss begin by listening to sentences and phrases. Performance in discrimination tests determines the extent of drill with isolated words. If the loss is great in the frequencies between 2,048 and 8,192 cycles per second, the patient learns which high-frequency consonant sounds must be identified by speech reading alone.

Specific listening for the patients in the marginal-loss group is conducted in much the same pattern, except that drill is based primarily upon identifying high-frequency consonants and the voiceless stops (*p*, *t* and *k*). It is anticipated that normal auditory acuity may be restored for these men. In some cases, better listening habits are developed so that the patients are able to make greater use of their residual hearing without amplification.

Using the hearing aid in life-situations

The second phase of auditory training is concerned with teaching the patients to use their hearing aids in a variety of life-situations. The patients are encouraged to experiment with their aids, practical demonstrations are set up in the classroom, and free discussion stimulates the exposure of particular problems that arise as they move about the hospital and in the city.

Optimal settings of volume- and tone-controls are determined. Problems of clothing noise, cord static, methods of wearing an aid for maximum comfort and performance, and the best use of batteries are some of the topics included in classroom procedure.

The length of time necessary for the initial adjustment to a hearing aid varies from 3 days to 2 weeks. During the first few days the wearer is continually annoyed and confused by the number of sounds heard simultaneously. The ability to concentrate on what one wishes to hear and to ignore the background noises must be developed. This requires practice in identifying and locating ambient noises. A series of sound-effects records is used in the classroom to provide suitable material and stimulate interest. Drill in sound-localization is conducted in a large lecture room where the live voice is employed by means of four amplifiers.

The rehabilitees are given an opportunity to listen to both men's and women's voices and to a variety of musical recordings. Although

hearing-aid wearers usually find it easy to converse with one person in quiet surroundings, a noisy place presents difficulties. Much classroom training is concentrated on practice with conversation superimposed on background noise. Special attention is paid to the use of the telephone while wearing an aid.

This phase of the work is graduated so that the patient moves from relatively simple listening situations to those that are complex. Performance is further checked by the work therapy program, under which men gain experience on the job in local industry in gaging the effectiveness of their hearing aids.

To provide further concrete data for both instructor and patient, each man carries out a series of specific assignments; these include many normal situations, such as going to the movies, listening to the radio, and conversations amid city traffic noises, and are listed on a record sheet so that a man may record his own judgment of his performance. These reports are then analyzed in class, an experience which enables the men to make tangible comparisons and which tends to support their confidence in the performance of an aid.

Presenting the foundation for an understanding of functional hearing

The third purpose of auditory training is to present the foundation for an understanding of functional hearing. Every rehabilitee is interested in his own hearing problems and in the significance of the various tests to which he has been subjected.

A simplified explanation of the anatomy and physiology of the ear, with ample time for discussion, has proved useful. From discussions of aural pathology the patient gains knowledge of common causes of impaired hearing and some insight into his own disability.

A full description of the methods and findings of hearing quantification is included in classroom instruction. Routinely the patients have had a number of audiometric and functional tests, and they are keenly interested in knowing their significance. Each man has an opportunity to study his own audiogram, and to consider the gain available with his hearing aid, with special attention paid to areas of distortion.

No auditory training program would be complete without special emphasis on the problems of speech. Lectures are presented on the elements of normal speech with particular attention to the psychosocial aspects of clear communication. The "deaf voice" is analyzed and each man trained in methods of avoiding its development.

Consideration of postservice problems

The fourth and final aspect of the auditory training program is the consideration of postservice problems as they relate to the use

of a hearing aid and to hearing disability in social and economic terms. It is of prime importance that the rehabilitee understand the necessity of preserving his residual hearing. Measures to preserve it are considered in detail. The physical characteristics of a hearing aid are explained, and eventualities of damage or injury from weather, exposure and careless handling are anticipated.

It is hoped that the psycho-social-economic future of our patients will be affected in part by what they have gained in mental hygiene and in part by their knowledge of the psychology of deafness. Mannerisms and attitudes associated with deafness are freely described and analyzed in terms of social and vocational contacts. Both the capabilities and the limitations of the individual are dwelt upon. The relation of various occupations to tolerance-levels are analyzed. and, in general, an effort is made to foresee whatever problems may arise among the individuals of the group.

COMMENT

A few topics already referred to warrant further discussion.

1. It cannot be overemphasized that our program of auditory training has been developed without precedent. Both inclusions and exclusions of content-material reflect our understanding of the re-educational needs of almost 3,000 deafened sailors and Marines. On the foundation of a variety of information pertinent to acoustics, physics, otology, sociology and psychology, the course has been shaped and reshaped solely in terms of what has proved practical in the exacting task of teaching our patients how best to use their residual hearing and adapt their communicative habits to the limitations of a hearing aid.

2. Our experiences with sound-discrimination tests have varied somewhat from their use by other specialists in the field. Designed essentially to provide objective data on exact performance of auditory reception, these tests have proved more useful as training devices than as measurements of auditory intelligibility. The simple fact is that patients who have suffered hearing loss from heavy fire and concussive blasts cannot perceive high-frequency sounds.

Nor does the use of a hearing aid vary this limitation; as yet, even the best types of vacuum-tube aids do not pass the high frequencies of the voiceless fricatives, particularly *s*, *sh*, *f*, and *th*, which occur so frequently in English. Accordingly we have dispensed with sound-discrimination tests to measure auditory acuity. Inasmuch as we are primarily concerned with an individual's ability to follow normal conversation, and with the fact that his ability to distinguish isolated words is not always an important criterion of auditory intelligibility, we employ sound discrimination principally as drill-work.

For many patients this activity provides analytic material to determine specifically the sounds which must be perceived by vision and kinesthesia. For others, sound-discrimination drills help to increase auditory acuity. And for some, particularly those in the marginal group, they foster better listening habits, both with and without amplification.

3. It is well to re-stress the value of group therapy in auditory training. As in speech reading, here too the variable personalities of the group provide a challenge and fertile ground for normal, varied situations and interests. It is through the free interchange of experiences and ideas that our patients develop intelligent habits of thinking about the significance of their disability.

SPEECH TRAINING AND CORRECTION

An introduction to the general principles of good speech and voice is complementary to the work in both speech reading and auditory training. As a matter of course, the daily work with articulation drills in speech reading, as well as the work with sound discrimination in auditory training, sharpen the articulatory habits of the rehabilitees and help to bring about a general toning-up of their speech patterns. Patients receive regular instruction in the fundamentals of breath control and in the development of effective pitch, rate, volume, resonance and quality. Exercise to these ends is part of classroom drill, and there is free discussion of methods for avoiding the "deaf voice."

The broad aim of this part of the re-education course is not to develop public speakers, nor to teach some particular type of pronunciation, but to help the men become aware of the close relationship between speech and hearing, to teach them discrimination in their own speech habits, and to help them guard against the deterioration of speech that is so often the concomitant of a hearing loss.

The great majority of rehabilitees offer no significant evidence of speech deterioration; their hearing disability is so recent that it has not yet begun to undermine their normal habits of articulation and phonation. For them the speech work is insurance against the future. Once they put on their own hearing aids, special attention is paid in auditory training to the adjustment to and control of their own voices, as each individual perceives his own.

The men are taught to check frequently with a person who has normal hearing, and to take advantage of frequent coaching. Many, however, whose histories show some degree of impairment prior to induction, with or without aggravation, require definitive speech correction. Then, too, patients who have suffered a profound hearing loss usually need special attention to speech problems, with the em-

phasis placed on kinesthetic cues to help them learn discrimination in their own speech habits. The department is amply staffed with experienced speech pathologists who are prepared to devote any reasonable amount of individual attention to cases that require it. Types of disability receiving this special treatment range from severe stutter patterns to cases of simple cluttering.

GROUP THERAPY

The important contribution of group therapy to the technics of re-education has already been indicated. Aside from the use of this device in the prescribed retraining courses, it is also employed in a special series of aural rehabilitation meetings. Twice each week the aural rehabilitees are brought together for an hour to hear generalized discussions of their problems. These lectures cover a wide range of material with a measure of success that warrants serious consideration in the development of aural therapy for civilian groups.

Four talks are specifically concerned with the psychology of hearing and mental hygiene. The first is designed to create rapport and to stimulate a genuinely objective approach to hearing problems on the part of the patient. Rehabilitation is explained as a dual process wherein we undertake to help a person save his self-respect despite a severe sensory handicap, and to give him the tools wherewith he may adjust to this handicap in a competitive world. The development of the program is outlined, staff personalities are identified and the retraining course is explained. The patient learns at the outset that the staff is sympathetic but not sentimental, that we understand the problems of deafness and believe they must be met, that our goal is so to train a man that he becomes an efficient person despite his handicap.

The second lecture is concerned with an analysis of behavior. The nature of basic human drives, habits, attitudes and prejudices is suggested; social and biologic heritages are outlined, and the pattern of development with relation to hearing disability is sketched.

The third discussion is concerned with ways and means of affecting human behavior in various ways, through training, by means of both controlled and uncontrolled behavior, and by details of environment. These questions are specified in terms of the psychology of deafness, so that the rehabilitees may have some understanding of their own habits and tendencies.

The fourth lecture considers what may happen to the hard-of-hearing person, supplied with the tools we can give him in a world not yet educated in matters of hearing therapy; the rehabilitee learns why he must become a specialist in deafness, and how much his own attitude may condition that of the group in which he finds himself.

In short, a serious effort is made to make the aural rehabilitee as intelligent as possible about his handicap.

Two lectures are delivered by otologists attached to the department and are specifically concerned with clear explanations of the hearing mechanism and its ailments. The first offers a sketch, amply illustrated by visual aids, of the anatomy and physiology of hearing; the second includes a discussion of various pathologic conditions that obtain in the service population, and considers in some detail the effect of various etiologic factors upon the hearing function.

A seventh lecture deals specifically with the physical attributes of a hearing aid, and with observations on its care and use. The men are made familiar with the various parts of an aid; they hear an explanation in simplified terms of the conversion of sound to electrical impulses and back again; and they are given straightforward advice on various problems such as cord noise, clothing noise, the effects of temperature changes and the like.

A final talk is devoted to a careful discussion of typical vocational problems to be met by the person who wears a hearing aid. The kinds of jobs that carry the threat of further acoustic trauma are suggested, and some time is taken to analyze typical difficulties to be met in the competitive job market.

The men are given ample opportunity to ask questions and to satisfy their own particular problems of adjustment. As with all group treatment, this approach to the individual's re-education has been found an effective ally of the more technical work in speech reading and in the retraining of auditory skills. Devoted as we are to the clinical, individualized treatment of hearing disabilities, we are well assured that this use of group therapy has proved valuable to the over-all rehabilitative task.

SUMMARY

The re-education program in Hearing and Speech Rehabilitation at the U. S. Naval Hospital, Philadelphia, has evolved from the patients' needs. In order to achieve our goal, that deafened Navy and Marine personnel may live normal, socially and economically sufficient lives, it was necessary to retrain the individual's communicative habits. This entailed the development of a closely correlated program based on the principle that communication involves a closely interrelated series of auditory, visual and kinesthetic stimuli and motor responses. The deafened patient is trained to utilize a complete motor-sensory approach in order to reinforce the faulty auditory pattern.

Accordingly his retraining program is composed of two basic courses, each of which emphasizes the psycho-physiologic interplay

of linguistic habits and skills. *Speech reading* is concerned with the deafened person's ability to use visual and muscular cues to enhance or replace the faulty auditory percepts; *auditory training* teaches him how to use his residual hearing with the supplement of a hearing aid. The content of these two courses, together with a special program of group therapy and the nature of the *speech training* available, are described in some detail.

Certain findings of particular interest to the re-education specialist are discussed. In both speech reading and auditory training, it has been determined that small, homogeneous groups provide the optimal learning situation. Moreover stress is thus placed upon the consideration of life situations as study material, a necessary aspect of sound rehabilitation. The procedure in both courses is based upon short, frequent class sessions. It is felt that further progress in the methodology of speech reading will be conditioned by experimental evidence to determine the capabilities and limitations of the speech reader, and to provide standard diagnostic tests. In auditory training the use of sound-discrimination tests for measuring auditory acuity has proved unsatisfactory, although they have served capably as drills. Special emphasis should be given to the efficacy of group therapy in the reconditioning of the person with a hearing disability.

The integration of speech reading, auditory training and speech correction into a unified program necessitated a fresh approach to many problems of work with the hard-of-hearing. Faced with the need to produce a specialized instructional and clinical service to deafened personnel of the Navy and Marine Corps, we had to develop new methods, guided for the most part by the findings of extensive experimentation and change. It is believed that our experience in the aural rehabilitation of nearly 3,000 hard-of-hearing persons is worth recording.

IX. ADJUSTMENT OF THE HARD-OF-HEARING AFTER LEAVING THE SERVICE

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In this paper are presented certain statistical findings based on a follow-up of patients of the Hearing and Speech Rehabilitation Unit of the Philadelphia Naval Hospital. These data were sought in order to accomplish several definite aims. It was desired first of all to know just how well graduates of the rehabilitation program compete with normal persons when civilian life has been resumed. It was believed that suggestions from these veterans would be highly valuable in formulating practical changes in the program. It was also believed that patients currently assigned to the program would profit from a knowledge of the experiences of their predecessors. An effort has been made to analyze these results and draw certain conclusions concerning the adjustment of hard-of-hearing persons who have left the service.

In order to measure the effectiveness of the Hearing and Speech Rehabilitation Program in terms of civilian readjustment, a questionnaire was devised. This questionnaire is mailed to the former patient approximately 2 months after he is discharged from the hospital. There were 543 questionnaires returned from 1,272 mailed. The following percentages were calculated on a population of 504 former patients. The questions asked are quoted below with appropriate response percentages.

1. *Do you still use your hearing aid?* Returns indicate that 94 percent are still using their hearing aids. (*If you have discarded it, tell us why.*) Reasons given by the 30 persons no longer using their aids were: Need batteries; need repairs; aid of no help; causes nervousness; causes headaches; aid is too awkward to wear; hearing has returned; aid makes ear sore; prefer to read lips; hear conversation all right; aid provokes tinnitus; and public disapproval.

2. *Do you think your hearing has changed since you have been using the hearing aid?* An evident change in auditory acuity is indicated by 34 percent, whereas 66 percent report it has remained the same.

3. *Have you had difficulty in obtaining batteries?* Such difficulty is claimed by 24 percent.

4. *Have you had difficulty in getting satisfactory repair service for your aid if it has needed it?* Eight percent have been unable to get repair service; this figure is probably low because repairs would not yet be necessary.

5. *Have you been refused a job, or been unsuccessful in one you chose because of your hearing deficiency?* An affirmative answer comes from 23 percent.

6. *How much has lipreading helped you to understand conversation?* Three subdivisions were suggested in the questionnaire. Accordingly 52 percent reported "greatly," 35 percent reported "moderately," and 13 percent responded "slightly."

7. *Have you studied lipreading since your discharge?* Those continuing this study total 45 percent.

8. *What help do you now wish we had provided that you did not receive?* Suggestions given for improving the rehabilitation program were made by 182 persons: Fifty-five persons requested more speech reading; 20 asked for more help from the Veterans' Administration. Other suggestions, in order of frequency, were: (1) More experiences with practical situations; (2) higher disability pension; (3) specific vocational guidance; (4) speech correction; (5) try more different hearing aids; (6) receive more medical attention; (7) hear more different voices; (8) more detailed diagnosis and prognosis; (9) mechanics of the hearing aid explained; (10) better fit of ear mold; (11) longer training period; (12) attend academic schools; (13) more guidance toward civil readjustment; (14) public should be educated to receive the deaf; (15) aid issued sooner; (16) more music training; (17) separate classes by type and degree of hearing loss; (18) continue mental hygiene lectures; (19) have fenestration operation; and (20) improve hearing-aid switches.

COMMENT

One evidence of the carry-over of positive conditioning into civilian life is the high percentage of persons still wearing their aids. The gradual transition begun during the training period continues into civilian life unaccompanied by feelings of abrupt change. This possibly accounts for the fact that only one person gave as his reason for discarding his hearing aid the feeling that it aroused curiosity and disapproval in public. The data indicate that reasons for discarding the aid more frequently center around the mechanics of the aid rather than the individual's attitude toward wearing the aid.

The chief difficulty expressed by former patients is that of obtaining batteries and repairs. They had been instructed to take full advantage of the facilities of the Veterans' Administration. Especially in outlying districts is difficulty experienced in readily obtaining such assistance. In some offices, the policy holds that batteries and repairs will be issued only to veterans given a 10-percent rating of disability by the Veterans' Administration. This comprises a very

real problem to persons financially unable to purchase batteries and repairs from local hearing-aid companies.

The prospectus for vocational placement of hard-of-hearing veterans is not unfavorable. According to figures compiled on 1,800 patients interviewed by Educational Services, 50 percent planned to return to their pre-war jobs, 22 percent had new jobs awaiting them, 13 percent were returning to school, and 15 percent were undecided. The figure previously given which indicated that 23 percent of former patients have actually had trouble getting a job or in successful performance on the job is probably more apparent than real. This surmise is made because the majority of that 23 percent went on to say that even though they had difficulty at first, they were now working and performing satisfactorily in terms of the hearing handicap. In elaboration of this question in the form letter, many veterans stated that the speech reading training had been of inestimable value, particularly where working conditions were noisy. From the information now available, it would appear that hard-of-hearing persons have found jobs with certainly not more than the average amount of difficulty.

The continued interest in speech reading by 45 percent of these veterans is obvious evidence of its value in everyday life. Most of these people do not depend on lipreading entirely, because in the majority of cases, residual hearing is sufficient to furnish substantial cues in communication. It is not concluded that the 45 percent who state they are still studying speech reading are enrolled in formal classes, but rather that they are making special efforts to get consistent and constant practice through the cooperation of family and friends. The feeling of need for further speech reading training is emphasized by the fact that the highest frequency of suggestions for improvement of the training program was centered in more lipreading or a longer period of lipreading training. In this connection, it may be hoped that civilian classes in speech reading will become increasingly available.

SUMMARY

A follow-up study, based on replies of 504 hard-of-hearing veterans to a questionnaire sent 2 months after their discharge from the Rehabilitation Service in this hospital, shows that their major problems of adjustment seem to fall in four categories: (1) Care of residual hearing; (2) maintenance of maximum mechanical performance of the hearing aid; (3) adjustment to the job in terms of the hearing loss; and (4) achievement of the relatively proper mental hygiene level in relation to the social and economic processes.

In both the care of residual hearing and the maintenance of hear-

ing aids, it is hoped the veterans will find it increasingly easy to obtain help through the facilities of the Veterans' Administration. Periodic otologic examination and audiometric tests will be necessary for proper care.

Hard-of-hearing veterans have been quite successful in the competitive economic situation. Although a small percentage have had two or three failures in locating work, the number eventually unemployed is relatively small. The veteran equipped with a hearing aid, relatively proficient in speech reading, well-informed as to the extent of his hearing loss and the care it requires, will in most cases be able to compete successfully in the vocational world.

It is necessary for the hard-of-hearing veteran to maintain a certain psychologic set, which means that he continues to feel competent in performing satisfactorily, notwithstanding his hearing disability. Whether or not the positive conditioning factors which were set up during the rehabilitation period will continue to operate after the veteran resumes his place in civilian life will depend largely upon a normal sort of acceptance from his family, friends, and employer. Hard-of-hearing persons leaving the service can be expected to achieve normal adjustment; however they are entitled to the support and understanding of the Veterans' Administration and the general public.

In all the problems mentioned in letters from former patients or returns from questionnaires, psychologic difficulties appear to be relatively few. For two reasons, the so-called "deaf personality" is not ordinarily associable with these veterans. In the first place, these men for years have thought and acted as completely normal people; the habits of a lifetime are not ordinarily completely disrupted by the occurrence of a hearing loss. Second, everything these men have experienced up to the time of discharge has been pointed toward the continuation of normal habits and attitudes. Feelings of security and confidence result from proficiency in speech reading and a properly fitted hearing aid.

Obviously there is an inherent difference between persons deafened in adulthood and persons who are congenitally deaf. This difference is capitalized on and emphasized during the training program and would ideally be carried into civilian life. The men are not deaf; they are hard of hearing. This is a new condition in most cases. Therefore no necessity exists for treating these veterans as deaf people. The speech and, more generally, the personality of a patient are those of a completely normal person, which makes a vast difference in the type of adjustment he should make. The patients are indoctrinated with this idea; they are further advised to solicit the understanding of their friends and family in achieving this goal.

D. REHABILITATION OF THE BLINDED

I. TRAUMATIC BLINDNESS

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The first blinded war casualty was admitted to this hospital in January 1943. By April of 1944 six such patients had arrived here and a program for their re-education and training had been evolved. On 4 July 1944 the Surgeon General designated this hospital as the national center for the rehabilitation of blinded personnel of the Navy, Marine Corps, and Coast Guard. Since then 157 patients have been admitted, an incidence of about 1 blinded in every 1,000 of the 148,880 casualties since 7 December 1941.

Our program has been accordingly elaborated and enlarged. Methods and technics of treatment were perfected and an excellent staff of instructors and technicians brought together, with the result that personnel who have suffered blindness are taken through a carefully coordinated course of retraining designed to give them a thorough basis for the difficult business of living normal lives in a seeing world. The experiences gained in the management of these patients are here set forth by the members of our staff in a series of reports that constitute a symposium on the rehabilitation of the blinded.

This hospital received men whose vision was found to be 2/20 or less. Every effort was made by all medical facilities to transfer them to this rehabilitation service as soon as possible after the diagnosis of blindness had been made and transportation was feasible. Only patients in whom the prognosis was nil or very poor for restoration of vision were admitted for rehabilitation.

The routine of procedure is as follows: On admission to the hospital, the patient is examined by the ophthalmologist in charge, who supervises all medical and surgical care and directs the program for the blinded. When his physical condition has been determined and medical or surgical treatment has been outlined, the patient is interviewed by the supervisor of re-education. At this time his program of care and retraining is fully described for him, his questions are answered, he is introduced to his physical situation in the hospital, and first steps are taken to allay his fears and anxieties and to encourage the development of emotional security. After a social his-

tory is obtained, the patient's family is contacted and the program is outlined to them.

All patients are given training in orientation. They are shown how to travel about in the hospital, around the grounds and in the city. Training in eating habits, care of personal possessions, use of the cane, dialing a telephone, identification of money, etc., is given by members of our staff who devote their entire time as teacher-attendants for the blind. Each patient studies Braille and is given at least 36 lessons in typing. Upon completion of the typing course they receive a portable typewriter as a gift.

Work experience is offered in our Occupational Therapy Department as well as in the Navy Yard and in Philadelphia industries. We have a store in the recreation ward where the blind sell everything from razor blades to Chanel No. 5. They get a tremendous kick out of it and the experience has stimulated some to open a small retail business for themselves after discharge from the service. X-ray film developing is offered in our x-ray department and three of our former patients are doing very well developing x-ray films in large hospitals.

A member of our Educational Services staff specializes in vocational and educational counseling for the blind. Vocational guidance is based on the results of personal interviews in the hospital, vocational testing at the New York Institute for the Education of the Blind (where each patient spends 2 weeks), job try-outs, and group discussions by the staff, of each rehabilitee.

Physical training especially adapted to the blinded patient develops coordination and social adjustment, as well as furnishes general bodily conditioning. Calisthenics, various gymnastic games, rowing, wrestling, bowling, archery, swimming, and many other activities provide ample opportunity for both group and individual participation in athletics.

General recreation is under the direction of the American Red Cross. Games and a variety of social events, including frequent dances, are conducted in the hospital. Activities outside the hospital include parties and dances, and frequent visits both to public centers and to private homes in the district.

Rehabilitation of newly blinded young adults includes many factors which had not been well explored before this war. Therefore it was necessary to do considerable pioneer work in the re-education and counseling of these young men. Mechanical ability and aptitude tests were revised and scoring methods improved. Teaching technics in typing, Braille, orientation, and use of the cane have been changed as our experience developed. Vocations commonly associated with the blind such as broom making, chair caning, basketry, and weaving

have been assiduously avoided in our occupational therapy department and vocational counseling. A certain percentage of our rehabilitees will no doubt be happier and better adjusted in a sheltered workshop, but this is not a sufficient goal for most of the men. A blinded veteran willing and able to return to his home and earn his living in competition with sighted people is, in our opinion, the most healthy result possible from rehabilitation.

Since V-J Day, our case load is decreasing steadily and our program will soon be drawing to a close. This appears to be the logical time to report our experiences in the Rehabilitation Program for the Blinded at this hospital.

This paper presents a survey of the cases of blindness due to ocular injury.

A total of 157 blind patients has been admitted to the blind rehabilitation service from January 1943 to November 1945. Of these, 99 (63 percent) suffered their disability as the result of external trauma. Blindness resulting from nontraumatic causes in 58 cases will be considered in detail in a separate article (II). The following presentation is concerned only with those blinded as a result of traumatic violence and includes an analysis of injury, the types of traumatic agents, associated injuries and primary eye injuries. All utilized forms of surgical and nonsurgical eye therapy are considered and evaluated as to effectiveness. The advantages of evisceration over enucleation are discussed. Reference is made to the types of prostheses used. A brief discussion of the reactions of these patients is presented.

Age and service distribution.—Among the 99 patients were 79 Marines and 20 sailors, whose ages varied from 19 to 40 years, the average being $24\frac{1}{3}$ years.

Circumstance of injury.—Land and sea combat accounted for 71 and 9 respectively, while the remaining 19 cases resulted from accidental injury. None of the cases of accidental blindness resulted from liberty accidents; however 4 of them could be attributed to carelessness and 1 to a state of temporary insanity in which suicide was attempted. Seventy (88 percent) of the 79 Marines were blinded as a result of land combat, while only 10 (50 percent) of the sailors were injured during action. This is partly explained by the fact that Naval personnel were required to handle heavy and high explosives when not in combat, while the Marines were subjected to fragmentation explosives during their engagements.

Theaters of combat.—Only 2 (2.5 percent) of the 80 combat casualties sustained their injury in the European theater, while the remaining 78 were incurred in the Pacific war. The combined Naval and land assault operation of Iwo Jima, Okinawa, Guam and Saipan accounted for 21, 13, 11, and 8 blindness cases respectively, a total

of 53, or 66 percent. Three cases each resulted from the Peleliu, Tarawa and Tinian campaigns.

Traumatic agents.—An analysis of the traumatic agents presents two notable features, in that bullets accounted for loss of vision in 26 instances and only one person was blinded as a result of burns. This distribution is interesting in view of the modern methods of warfare. The outstanding value of the Japanese mortar is again reflected in the fact that 22 men were wounded by mortar fire, while the 18 grenade injuries reflect the intimacy of land combat. Six men were blinded by land-mine explosions. Bombs and shell fire resulted in visual loss in 6 and 5 instances each, while only one patient was injured by torpedo explosion. Other explosions accounted for 14 cases.

Associated injuries.—With the exception of one patient who sustained corneal chemical burns from fulminate of mercury contained in a torpedo detonator, all of these patients suffered associated injuries, the most common of which was facial disfigurement, which was present in 83 of the 99. Cranial nerve injuries were present in 37 of these cases, while 2 others were hemiplegic and one patient sustained injury to the cauda equina. Loss of the sense of smell was noted in 17 instances and loss of taste sense in one. Deafness occurred in 18 men and was bilateral in 11.

Loss of hearing in every case was due to nerve injury; however the degree of deafness was not sufficient to necessitate a hearing aid in any of them. The remaining patient with a cranial nerve lesion demonstrated loss of sensory powers over the distribution of the right fifth nerve. Seven patients presented peripheral nerve lesions. Associated soft-tissue foreign-body wounds of the trunk and extremities occurred in 53 patients, while two others had associated burns. Thirty-nine of the ninety-nine presented skull fractures with various degrees of osseous mutilation. There were 3 mandibular fractures. Ten men who suffered visual loss also had fractured extremities, while 2 others had major limb amputations and 2 lost fingers.

Primary eye injuries.—For the sake of simplicity, the primary eye injuries have been divided into three main groups including injuries without global perforation, irreparable penetrating global injuries and perforations of the globe without complete functional loss.

The nonperforating eye injuries included 17 unilateral and 5 bilateral. These are presented in table 1 in terms of the nature of the injury. Seventy-two patients suffered severe and irreparable eye damage at the time of injury. In 20 of these the destruction was bilateral. The remaining 79 eyes were perforated but blindness was complete in only 3, since 76 retained light perception or more.

Period between injury and admission here.—Prior to admission the time elapsed between injury and arrival at this center varied from

4 days to 13 months, with an average of 3.5 months. During this time, unilateral enucleation had been performed on 55 of the men and bilateral on 11. Foreign bodies had been removed from 5 eyes in 5 patients, while 1 had had a cataract operation and another had been operated upon for retinal detachment. Bilateral lacerations of the eyes were sustained by one patient.

TABLE 1.—*Visual injuries without global perforations*

	Unilateral	Bilateral
Concussion resulting in traumatic choroiditis.....	4	0
Burns, chemical.....	0	1
Retinal detachment, partial.....	1	0
Retinal detachment, complete.....	3	1
Optic nerve injury.....	9	1
Visual tract injury.....	0	2
Totals.....	17	5

Condition on admission.—On admission to this hospital, 55 patients had had unilateral enucleations and 11 had had both eyes removed. Phthisis bulbi was present in one eye of 25 individuals and in both eyes of 7. Optic atrophy was present on one side in 8 and in both eyes in 1, while 1 patient had bilateral visual tract blindness and another presented a homonymous left hemianopsia. Only one patient had a convergent squint. The remaining eyes presented various injuries and sequelae which interfered with vision, as shown in table 2.

Vision on admission.—At the time of admission, vision was nil in 1 eye of 38 patients and in both eyes of 42. Light perception was present in both eyes of 10 and in 1 eye of 28. Vision in the 31 remaining eyes varied from 1/200 to 8/20. Only 4 patients had some degree of vision in both eyes.

PLAN OF MANAGEMENT

The program of blind rehabilitation was divided into medical and surgical treatment and rehabilitation, the latter being the most time consuming. The duration of hospitalization in 77 discharged patients varied from 1½ to 21 months, with an average of 4½ months. Medical treatment included general supportive care as well as the specific therapy for concomitant diseases. Surgical procedures were performed to improve vision, eliminate disfiguring scars, and to correct or improve other existing associated wounds.

Nonsurgical ophthalmologic therapy.—Nonoperative therapy included the care and instruction in the care of the eyes or sockets, which was chiefly concerned with cleanliness and the prevention of infection and irritation. Specific nonsurgical therapy was given to

TABLE 2.—*Conditions present on admission in 99 blinded patients*

	Unilateral	Bilateral
Enucleated.....	55	11
Visual tract blindness.....	0	1
Phthisis bulbi.....	25	7
Optic atrophy.....	8	1
Left hemianopsia.....	0	1
Convergent squint.....	1	0
Retinal detachment, complete.....	5	0
Retinal detachment, partial.....	2	0
Choroiditis, traumatic.....	16	3
Intra-ocular foreign bodies, posterior chamber.....	13	8
Intra-ocular foreign bodies, anterior chamber.....	2	1
Vitreous opacities.....	31	9
Tension minus.....	25	8
Aphakia.....	1	0
Cataract, traumatic.....	19	7
Secluded pupil.....	3	0
Corneal opacities.....	30	12
Totals.....	236	69

8 patients, 2 of whom received x-ray therapy in an attempt to cause constriction and obliteration of newly formed corneal blood vessels—to both eyes in one patient, and to prevent recurrence of an implantation cyst in one eye of the other. X-ray therapy proved to be successful.

Six were given gold sodium thiosulfate in hopes of promoting absorption of vitreous opacities and thus improving vision. While gold sodium thiosulfate was found to be of questionable value, vision in one patient improved in one eye from 4/200 to 17/20, in the other eye from 4/200 to 4/20; in another patient who had had one eye enucleated, vision improved from 3/200 to 15/20 in the remaining eye. These patients had sustained their injuries 3 months and 5 months, respectively, previous to gold sodium thiosulfate therapy. There had been no indication of vitreous clearing prior to this treatment. No surgical procedure was performed here on either of these men. The evaluation of gold sodium thiosulfate in the remaining four was confused by later surgical intervention; however it was felt that this therapy may have been a factor in the improved vision obtained.

Surgical ophthalmologic therapy.—Fifty-six of the 99 patients did not require eye surgery, while 12 of the remaining 40 were subjected to operations on both eyes and 29 underwent surgical procedures on 1 eye. Surgical treatment is considered incomplete in 8 patients, 3 of whom have not as yet been operated upon. The eye operations performed had two distinct purposes; to improve vision, or to render the eye suitable for the use of a prosthesis.

Operations to restore or improve vision.—Operations to improve vision were performed on 29 patients, 7 of whom had operations on both eyes. If light perception was present, and if there was any hope of restoring vision by surgical intervention, then suitable pro-

cedures were carried out. Twenty-one of these eyes presented low intra-ocular tension (below 10 mm. of mercury pressure as determined with the Schiøtz tonometer) necessitating sharp cutting instruments to minimize the hazards presented by "soft eyes." Eighteen of the eyes operated upon contained two or more foreign bodies in the posterior chamber, none of which were removed. It was surprising that these metallic particles were tolerated without evidence of irritation or infection.

Cataract operations to remove or release the lens were performed on one eye of 20 patients and on both eyes of 5. The formation of a new pupil by optical iridectomy was done on one eye of 9 of the men and on both eyes of one man. Retinal detachment operations were performed on one eye of 3 patients, and keratectomy and iridectomy, with removal of implantation cyst, were done on one eye each. Four patients had foreign bodies removed from the anterior chamber, in one of whom the procedure was performed bilaterally. In this group of cases vision was improved to better than 2/20 in 13 cases, and 6 improved but remained less than 2/20. In 7 instances vision was unimproved, while final vision has not yet been determined in 3.

In this group of cases, there was no evidence of gross infection or other postoperative complications. Prophylactic pre- and postoperative penicillin therapy was not used.

Operations to prepare eyes for prostheses.—In total, 13 eviscerations were performed because of phthisical eyes. Of these only one was a bilateral evisceration. This operation, which consists of removal of the cornea and uveal tract, is designed to retain a normal stump for the prosthetic eye and permits a more natural appearance, since ocular motion is retained in part. In our opinion evisceration results in a more satisfactory socket for the insertion of an artificial eye than is usually obtained following enucleation with or without an implant. For this reason enucleations were not performed in this series when intra-ocular tumor did not enter the diagnostic picture. Tissue removed during evisceration was sent to the pathologic laboratory for study. No complications were seen as a result of evisceration. One other patient was operated upon because of strabismus.

One patient in this series of 99 died as a result of a brain abscess. His death occurred 24 days after admission here. He apparently had a meningitis with purulent spinal fluid and for a time improved under penicillin treatment. Then he rapidly lapsed into coma and died. At autopsy the explanation was found in a huge abscess, secondary to foreign bodies (shell fragments) and replacing nearly the whole right cerebral hemisphere. This man was not operated upon.

Other than this, there were no serious complications noted among the 59 nonoperative cases or the 40 patients subjected to surgery.

Corrective prostheses.—Unilateral spectacle lenses were provided for 16 patients and bilateral glasses for 3. Contact lenses were applied to the one eye of 7 persons, and 4 patients were fitted with unilateral telescopic lenses. In every instance these appliances resulted in an improvement in vision.

Ocular prostheses.—Earlier in this rehabilitation program, glass eyes were supplied to those who had had enucleation or evisceration. The construction and use of plastic prostheses came later; these were made to individual measurements by the Dental Department. Forty-eight patients were given glass eyes, half of these being bilateral prostheses. Twenty-three unilateral and 3 bilateral plastic eyes have been issued. Only one patient showed signs of irritation due to the plastic eye and was suitably fitted with a glass substitute.

The technic of and experience with the manufacture of plastic ocular prostheses are the subject of a separate communication in this series.

Plastic surgical procedures.—Thirty-two of the 99 blind patients were operated upon by the Plastic Surgery Department. Eleven of these required ocular plastic procedures, and 8 underwent facial plastic operations. Thirteen patients had both ocular and facial plastic operations.

Treatment of other associated injuries.—Fractures and amputations were managed by the orthopedic and amputee services respectively and carried through to receive final prosthetic fitting and rehabilitation as indicated. The department of brain surgery contributed to the management of those with nerve lesions.

REACTIONS TO BLINDNESS

It has been interesting to note the reactions of these 99 men to their blindness, because prior to injury they were all healthy young men. The reactions subsequent to blinding follow the typical course of depression, overcompensation, and finally a phase of reorientation and adjustment. The basic personality types reflect the excellence of screening in enlisted and drafted personnel, for 90 of the men were typical extroverts, while 7 appeared to be restrained or unduly depressed. Two patients with brain injury were confused and irrational at times and could not be evaluated as to adjustment. Only one of the 78 patients, however, went into a prolonged period of depression and poor adjustment. In 51 cases the period of overcompensation was either omitted or greatly reduced in its manifestations.

In 35 patients, the period of overcompensation after depression was either highly controlled or brief. Ten patients had a moderate period of overcompensation.

Vision better than 2/20, as shown in table 3, was restored for 13 of these men following surgical procedures, 2 following intravenous injections of gold sodium thiosulfate, and 6 others were removed from the blind classification when they were fitted with proper telescopic or contact lenses.

The final vision was nil in both eyes of 45 patients and limited to light perception only in 20.

TABLE 3.—*Final visual evaluation of 95 patients**

	O. D.	O. S.		O. D.	O. S.
Nil.....	64	60	4/20.....	1	1
Light.....	11	18	6/20.....	3	0
1/200.....	1	0	7/20.....	0	1
3/200.....	0	1	8/20.....	2	2
4/200.....	0	1	10/20.....	1	1
8/200.....	1	2	15/20.....	0	3
10/200.....	1	1	17/20.....	1	0
20/200.....	4	2	18/20.....	0	1
3/20.....	1	0	20/20.....	4	1

*The vision of 4 of the 21 patients still under treatment is undetermined at this time.

SUMMARY

1. The history and development of the program for the rehabilitation of the blinded of the Navy and Marine Corps at the U. S. Naval Hospital, Philadelphia, have been presented, and our experiences discussed as they pertained to those who were blinded by trauma.

2. A total of 157 patients have been admitted to the blind rehabilitation service. Of these, 99 were blinded as the result of external trauma.

3. Among the 99 patients were 79 Marines and 20 sailors. Land and naval combat accounted for 71 and 9 casualties respectively, while 19 resulted from accidental injury.

4. Bullets, mortar fire, and hand grenades were the traumatic agents causing blindness in 66 cases. This reflects the "close combat" type of warfare engaged in by the Marines.

5. Associated injuries were suffered by all men in this series, with the exception of one. These injuries varied from minor facial disfigurement to severe brain damage with hemiplegia.

6. Operations for restoration of vision were performed on 29 patients, 7 of whom had operations on both eyes. Vision was improved to better than 2/20 in 13 cases, and 6 were improved but vision remained less than 2/20. Evisceration was felt to be the operation of choice when removal of an eye was indicated.

7. Restoration of vision to better than 2/20 for 21 men was accomplished by surgery, medical treatment, and/or fitting of proper corrective prostheses such as spectacle lenses, contact lenses or telescopic lenses.

8. The fitting with cosmetic ocular prostheses is the subject of a separate report in this symposium.

II. NONTRAUMATIC BLINDNESS

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Of the 157 cases thus far received on the service for rehabilitation of the blind, 58 were due not to trauma but to various pathologic factors. All these patients had spent considerable time at other Naval hospitals and activities prior to their admission here; therefore we did not see them in the acute stages of the diseases which produced blindness. An analysis in terms of etiology is presented, and each of the main etiologic groups is discussed in the light of our experience.

Of the total of 58 patients, 41 were sailors and 17 were Marines. All were enlisted men, and the group's average age was 26.5 years. Table 1 presents an analysis of the group in terms of causal factors.

Methyl alcohol

The causative factor in the greatest number of cases was the ingestion of methyl alcohol. These numbered 28; therefore nearly 50 percent of the nontraumatic cases of blindness were due to an avoidable cause. All these patients came from the Pacific theater of war.

Aside from the high incidence, there was nothing unusual about them. These men, with one exception, gave a history of drinking some unorthodox mixture known later to contain methyl alcohol. The substance consumed was variously stated as having been "ditto" fluid, torpedo juice, carburetor alcohol, anti-freeze, et cetera. The exception was the individual who insisted that he drank "good" liquor in profuse quantities for several weeks at which time he suddenly noticed visual failure while driving a truck. He was in a state of acute alcoholism when he reported for treatment. Since the liquor had been obtained on a small island in the Pacific, and from various sources, its alcoholic content was questionable.

The average age of these patients was 26.1 years, the youngest being 19 years of age and the oldest 37; 17 were sailors and 11 were Marines. The ratio of Marines to sailors in this group (1:1.5) as compared with the ratio of these services as a whole (1:6) shows a significantly higher incidence among Marines.

All gave a typical history of sudden onset of visual loss within 48 hours after ingestion of the poison. All had violent gastro-intestinal

TABLE 1.—*Causes of blindness in 58 cases*

Causes	Total number of cases	Sailors	Marines
Methyl alcohol.....	28	17	11
Retrobulbar neuritis (cause undetermined).....	8	6	2
Macular choroiditis, bilateral.....	7	7	0
Severe vitamin deficiency.....	6	3	3
Uveitis.....	2	2	0
Brain tumor.....	1	1	0
Cavernous sinus thrombosis.....	1	1	0
Diabetes mellitus.....	1	1	0
Secondary optic atrophy.....	1	1	0
Multiple sclerosis.....	1	1	0
Retinitis pigmentosa.....	1	1	0
Exposure keratitis.....	1	0	1
Totals.....	58	41	17

disturbances also at the onset. Their records show that all had an optic neuritis visible with the ophthalmoscope at the time the visual loss occurred. As the neuritis subsided, the vision improved for a few days in most cases but gradually failed again.

By the time the patients were admitted to this service, usually several weeks after onset, all had marked optic atrophy. Examination revealed pallor of the disks with the lamina cribrosa plainly visible. Visual fields were typical. All showed bilateral scotomata extending out from fixation to as much as 10 degrees. There was only slight contraction of the peripheral fields in the patients retaining more than light perception. Four patients had no light perception in either eye; seven had light perception only in each eye. The best vision obtainable in this entire group showed right eye 4/20; left eye light perception. In this latter case the peripheral field was markedly contracted in the better eye.

All of these patients had been given massive doses of thiamine chloride intravenously during the acute stage of poisoning, and at this activity continued to receive multiple vitamins supplemented by thiamine chloride. None showed any improvement in vision after admission here.

Retrobulbar neuritis and multiple sclerosis.—There were nine cases of retrobulbar neuritis producing blindness. The youngest patient in this group was 20 years of age and the oldest was 49 years, the average age being 28.9 years. Six of the men were sailors and two were Marines. All showed bilateral central scotomata when the fields were charted. These men were thoroughly studied for foci of infection, either at other activities prior to admission here, or if the studies were not complete, they were completed here. One patient was found to have badly infected tonsils and a tonsillectomy had been performed prior to admission. Another man had received treatment for an infected antrum. Six cases showed no foci of infection. All of these

men had neurologic examinations to determine the possible presence of multiple sclerosis. Only one man, a 21-year-old sailor, showed definite evidence of the latter disease, having right hemihypesthesia, diminished corneal reflexes, and absent pharyngeal reflexes in addition to temporal pallor of the disks and central scotomata. It will be interesting to follow the subsequent neurologic developments in these men.

Macular choroiditis.—There were seven patients in the series in whom the visual deficiency was caused by bilateral macular choroiditis. The youngest in the group was 20 years of age and the oldest 52, the average age being 27.9 years. All of these men were sailors. On admission one patient had 9/200 and 15/200 vision in the right and left eyes respectively. On discharge his vision had improved to 6/20 and 10/20, which was the best vision in the entire group. One patient had 4/20 vision in each eye, another had 3/20 vision in each eye. The remainder had less than 7/200 in either eye. One man had light perception only. These patients had all been studied for foci of infection prior to arriving here. All had been treated by the administration of typhoid vaccine intravenously for several doses. With the exception of the one case mentioned, the macular lesions appeared healed when first seen here and showed no signs of activity subsequent to admission.

Severe vitamin deficiency.—The most interesting group in this series of cases consisted of six men who had blindness associated with malnutrition and severe vitamin deficiency. The average age of this group was 28.7 years, the youngest being 23 and the oldest 36 years. Three of the men were sailors and three were Marines. These men had been imprisoned by the Japanese following the fall of the Philippines in 1942. Their daily diet while in prison consisted of about 250 gm. of rice and a cup of thin soup made from potato vine and radish tops. About once every 2 months a square-inch piece of fish was added to this diet. After 6 months on this diet, they began to experience visual failure which became progressively worse. At the same time they had been suffering from beriberi and pellagra.

Central vision was most affected, the peripheral field of vision remaining intact. One man stated that 3 months after the onset of blindness he was given several injections of vitamins intramuscularly by the Japanese. Following these injections, his vision showed no further impairment but there was no discernible improvement. One man developed a corneal ulcer in the right eye while in prison. This went untreated. When admitted here his right eye showed a large corneal leukoma to which the iris was adherent. An optical iridectomy was done, but the vision was unimproved.

Visual field examinations in these cases showed bilateral central scotomata extending about 5 degrees out from fixation. The peripheral fields were normal. These men have been given massive doses of multiple vitamins and thiamine chloride but their vision has not improved. In two of these cases the optic disks appeared normal. The others showed temporal pallor of the disks in both eyes. None of these patients had ocular muscle palsies.

Uveitis.—Two cases of uncontrollable uveitis produced blindness in this series. Both men were sailors 23 and 26 years of age. Both had severe plastic iridocyclitis. In spite of intensive treatment with cycloplegics, Kettering hypertherm, typhoid vaccine intravenously, sulfonamide drugs and penicillin, the uveitis progressed. Both men developed bilateral secondary glaucoma. One eye was enucleated. Vision was reduced to light perception with poor projection when these men were discharged from this hospital.

Brain tumor.—Brain tumor was the causative factor in one case of blindness. When admitted here, this man's vision was nil. Examination of the fundi revealed bilateral optic atrophy of secondary type. This patient, a 21-year-old sailor, was first admitted to the sick list in September 1943. One month later he was operated upon for removal of a cystic glioma of the cerebellar vermis. There have been no evidences of recurrence in the 2 years that have followed.

Cavernous sinus thrombosis.—On 18 December 1944, a 22-year-old sailor was admitted to this hospital who had had bilateral cavernous sinus thrombosis. Three months previously he had had a sty which caused an orbital cellulitis with subsequent involvement of the cavernous sinuses. He was treated with penicillin and appeared to have made a good recovery. Examination on admission here revealed bilateral choked disks. The vision was nil. Twelve days after admission the patient complained of headache and lethargy. He died on 11 January 1945, 12 days after the onset of these symptoms. An autopsy revealed a large abscess of the left frontal lobe.

Diabetes.—Diabetes was presumed to be the ultimate cause of one case of blindness. On admission this man, a 21-year-old sailor, had vision of 7/200 in the right eye and 10/200 in the left eye. Ophthalmoscopic examination showed bilateral central retinitis. This man had moderately severe diabetes. No other cause for the retinitis could be discovered.

Secondary optic atrophy.—One patient, a 23-year-old sailor, was admitted with bilateral secondary optic atrophy. His records revealed that he had a bilateral papillitis at the time he noted the onset of his visual failure. He had been taking atabrine for 5 days and this was promptly discontinued. All studies on this man failed to reveal any other possible cause for his ocular condition. He was

given thiamine chloride and multiple vitamins without improvement. The vision at the time of discharge from the service was light perception only in the right eye and 5/20 in the left eye. The left visual field was contracted to 10 degrees from fixation.

Retinitis pigmentosa.—The case of retinitis pigmentosa in this series occurred in a 19-year-old sailor. Six months after entering the service he complained of night blindness. Further questioning revealed that he had noticed poor vision for 10 or 12 years. The vision was 4/20, corrected to 14/20, in each eye. The visual field was contracted to 10 degrees from fixation in each eye. Ophthalmoscopic examination revealed retinal changes typical of retinitis pigmentosa. Only basic rehabilitation was given this man, since blindness was an eventual possibility even though he had useful central vision.

Exposure keratitis.—A 21-year-old Marine was admitted to the hospital with blindness resulting from exposure keratitis. The keratitis, complicated by perforating corneal ulcers, had developed while the man was in a prolonged coma resulting from a severe attack of malaria. At the same time he had a marked, generalized allergic dermatitis. On admission here the vision was nil in the right eye and light perception only in the left. The right globe was phthisical. The left cornea was completely opaque, the iris was adherent to the cornea at the sites of two old perforations, and the anterior chamber was obliterated.

SUMMARY

Of 157 cases of blindness seen at this hospital 58 were due to factors other than trauma. This group included 41 sailors and 17 Marines. Twelve casual factors have been discussed. Of these cases of blindness, 28, almost half the total number, were caused by the ingestion of methyl alcohol.

III. ACRYLIC EYE PROSTHESES

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The use of plastic materials in eye prostheses has been a great improvement over any former method of restoration. First proposed as a temporary measure by Holmes,¹ the method of applying the acrylic resins in the making of permanent cosmetic ocular replacements was developed during 1944 at the Naval Dental School, Bethesda, Md., by Murphey and his associates.² In December, 1944, the manufacture of acrylic eyes was begun at the U. S. Naval Hospital, Philadelphia. The present report concerns our experiences in the production of 200 such prostheses for 90 patients.

The development and application of plastic eye prostheses in the Navy had its origin in the urgent need for a more adequate method of eye replacement than that which existed prior to World War II. Returning casualties presented such a variety of problems that orthodox methods of restoration would not suffice. In many cases damages to the contents of the orbital cavity and to the bony structure surrounding it were so extensive that the ordinary glass prosthesis could not be worn. Some patients resorted to wearing patches rather than a prosthesis. To deal with this problem, a program was instituted at the Naval Dental School at Bethesda to develop an ocular prosthesis which would meet all requirements. In November 1944 a group of Naval dental officers was ordered to the Naval Dental School for instruction in ocular prosthesis. During the following 6 weeks, this group studied the anatomy of the eye, physical properties and processing of plastics, color theory, and technic of acrylic eye construction. At the end of this instruction period, each officer was sent to a hospital where his services could be utilized.

This activity was initiated at Philadelphia Naval Hospital in December 1944, under the direction of the writer, and began with a backlog of 18 patients. The first eyes were made entirely by the dental officer with the assistance of the medical illustrator who

¹ HOLMES, A. G.: Use of acrylic resin in construction of temporary artificial eyes. Dental Bull. (Supp. to Army M. Bull.) 12: 265-266, October 1941.

² MURPHEY, P. J.; PITTON, R. D.; SCHLOSSBERG, L.; and HARRIS, L. W.: Development of acrylic eye prostheses at National Naval Medical Center. J. Am. Dent. A. 32: 1227-1244, October 1, 1945.

painted the iris. Later a technician was sent from Bethesda who had been trained in various phases of laboratory technic. The service has been carried on in the dental clinic with no special equipment except that used for coloring.

The technic used is essentially the same as that originally taught at Bethesda. It has been found more expedient, however, to measure the iris directly instead of photographing the iris and then measuring it. It has been necessary in some cases, where the existing cavity does not have a retentive form, to alter the shape indicated by the original mold so that the finished prosthesis may resemble the conventional glass eye.

Since each case represents an individual problem, the results obtained hinge largely upon the skill and experience of the operator. Although a great many technical difficulties were experienced in the beginning, these have for the most part been eliminated so that, given a good case, it is possible to construct a prosthesis which defies detection. The cosmetic result is entirely dependent upon the illustrator's skill in painting the iris.

PROCEDURE

The following technic has been used at this hospital with a high degree of success, and is particularly adaptable to most of the cases treated here. The first step in constructing a prosthetic eye is a careful examination of the existing socket. In cases in which the socket is puckered or almost obliterated or in which the palpebrae are overlapping, it may be desirable to insert a plastic form, cut to the required size. As the soft tissues of the socket stretch, over a period of 3 or 4 days, the form may be gradually enlarged by adding wax to the periphery. After the cavity has attained a sufficient size, an impression may be taken with any colloidal impression material.

The impression is taken by placing a soft mix of impression material in a glass cylinder fitted with a plunger and, over the other end, a common rubber nursing nipple in the end of which a 3/16-inch hole has been cut. The nipple is placed between the lids and the material gently forced into the socket. The socket is filled and the material allowed to extend out over the lid so that a perfect negative is obtained of the inside and outside of the eye socket.

The impression obtained is surrounded with plaster of paris, which, after setting, results in a positive mold of the eye socket. This mold is then divided in half and used to construct a wax pattern. The pattern is fitted to the eye socket and adjusted to provide maximum movement and comfort and to restore as nearly as possible the natural contour. The finished wax pattern is then treated by

flasking in an ordinary compression flask with a compensating spring compress. After separating, the mold is lined with tinfoil. The visible portion of the sclera is then dry-packed in order to obtain a suitable color.

Sufficient blue-tinted opaque polymer is poured into the outer portion of the mold to extend about 3/16 inch beyond the periphery of the iris. This is wetted down with monomer. The remainder of that half is then filled with yellowish-orange tinted powder and wetted down with monomer. This is backed with opaque material which has been allowed to stand in the mixing jar until it has a rubbery consistency and is quite dry. The flask is closed, with cellophane between the halves, and placed in a press for 3 minutes. The flask is then opened, the excess is trimmed away, and after closing, the flask is placed in the compress. Curing should be done slowly for about 4 hours at 160° Fahrenheit. The finished sclera is removed from the flask and polished.

The completed sclera is placed in the eye socket and checked for movement, comfort, and contour. If the result seems satisfactory, the position of the iris is determined by measuring the position of the center of the remaining eye (in unilateral loss) and marking the corresponding point on the artificial sclera. If both eyes have been lost, a spot of dark wax is placed on each sclera at the approximate location of the center of the pupil. The scleras are then placed in the cavities and the arbitrary points are shifted until the operator is satisfied with the result.

After the iris has been located, a cavity is prepared in the sclera with suitable stones. The cavity should be exactly the size to accommodate the iris and present a slightly convex posterior wall.

The surface of the sclera is roughened with a stone, and the blood vessels are drawn with red ink and a quill pen. The sclera is covered with 24-gage casting wax to which is added a button of wax over the cavity prepared for the iris. The sclera is flaked, separated, and the wax washed away with boiling water. The case is then ready for the transparent covering.

At some time during the process of preparing the sclera, the artist paints an iris exactly reproducing the color and detail found in a natural eye. In cases where there is an existing eye, the illustrator is faced with the task of copying what he sees in the iris of the patient. The problem of painting irises for those with bilateral loss is a little different, since there is no existing iris to reproduce. The patient is asked what color of eyes he had, and then usually a search is made for a model with eyes of the color suggested by the patient. It is very important that the eye color blend with the complexion

tones and hair color of the patient, else the over-all result will not be pleasing.

The actual painting is done with water colors on tiny circles of water color paper of a size to correspond with the size of the iris. The usual size of the iris of a human eye is between 11 and 12 mm. in diameter.

First, a small circle is drawn in the center of the prepared paper circle with a compass and filled in with black ink. This is the pupil. Now the illustrator is ready to mix the basic eye color, which is the predominating color seen upon looking at a person's eye. This color is obtained by much juggling with the three primary colors, red, yellow and blue. If the eye is of a decided gray tone, just the right amount of complementary color must be added until the color is an exact match for the iris color. After this basic color is obtained, the painting is done with delicate radiating stroking and all of the feathery detail is reproduced until the illustrator is satisfied with the result.

The finished iris is allowed to dry and is then molded into a convex shape to fit the contour of the prepared sclera, and cemented into the shallow depression which has been cut out for it. Next, the transparent material, which has been prepared by wetting down with monomer and allowing to set until it has reached a rubbery consistency, is placed over the sclera and attached iris. The whole is covered with cellophane and the top part of the flask set in place. The whole flask is placed in a compress for 5 minutes, after which it is opened, any excess is trimmed away, and the flask again closed with fresh cellophane.

The flask is enclosed in a compress and placed in cold water, which is brought slowly to a boil, after which it is allowed to simmer for about 20 minutes. It is allowed to cool slowly and the eye is removed from the flask. There is usually some excess material adhering to the completed eye which must be carefully trimmed away with a stone. The surface of the prosthesis is contoured, care being taken to maintain a scleral sulcus.

The last and one of the most important steps in the construction of the ocular replacement is that of polishing. If the prosthesis is to simulate a natural eye, it must have an extremely smooth, shiny surface. This is obtained by careful work with a rag wheel, pumice, and rouge. At the completion of this operation, the sclera is subjected to a good soap-and-water scrubbing and is then ready for insertion in the eye socket.

If this technic is carefully followed, it will give uniformly good results. Details of color and appearance are limited only by the skill of the operator and the artist, and by conditions beyond their con-

trol, such as an unusually mutilated socket or lid. Great personal pride is felt by the patient when he is properly fitted with a prosthesis and need no longer fear to face the world because of his disfigurement.

CASE MATERIAL

Ocular prostheses have been constructed for 90 patients at this hospital. Of this number, 17 had suffered the loss of both eyes. The total number of eyes constructed is now two hundred. The large majority of these patients had lost their eyes through violence in battle and had suffered considerable mutilation of the orbital cavity and the surrounding tissues. These were the cases in which plastic prosthesis has been of the utmost value. Heretofore, it has been impractical if not impossible to attempt to fit badly mutilated eye sockets with the conventional type of glass eye. The plastic eye form constructed from an impression of the remaining cavity offers a means of dealing with this problem. By means of a graduated series of forms, the socket may be dilated to its natural size or at least to a size sufficient for the insertion of an iris. This procedure has been of great aid to the plastic surgeon in restoring lost portions of tissue surrounding the sockets.

Advantages

The chief advantages of these eyes are lightness of weight, durability, tissue tolerance, and permanence of color. There is no danger of the eye bursting in the orbital cavity as glass eyes sometimes do, and the material is unaffected by the fluids of the eye socket. Since the prosthesis is made from a positive plaster mold, which in turn is made from a negative impression of the cavity, the plaster mold serves as an excellent record of the case at the time the eye was made.

Not the least of the benefits derived from plastic eye prosthesis is the spirit of confidence and appreciation engendered in the patient, who feels that particular interest is being taken in his case. Even in cases in which it is impossible to obtain a good cosmetic result, the patient usually shows an improvement in morale. When good results have been obtained and the patient hears expressions of approval from friends and relatives, the improvement in morale is remarkable.

Disadvantages

One disadvantage has been encountered, and that in only one patient; namely, chemical irritation of the tissue lining the socket by the plastic material itself. In one of our most recent patients, a man who had lost one eye, the wearing of the prosthesis was followed

in 3 or 4 days by a gradually increasing outpouring of mucus. The irritation stopped soon after the removal of the prosthesis, only to recur with the resumption of its use. It became necessary to substitute a glass eye, and thereafter the patient had no further trouble.

This was probably an instance of idiosyncrasy on the part of the patient to the acrylic resin itself. It raises the question of the possibility of the development of a true sensitization to the material in some persons of allergic constitution. The possibility cannot be denied, but one would expect this to happen as a rule within a month or so of the first wearing of the prosthesis. Yet, thus far it has not occurred in any of our other patients.

A caution must also be mentioned with regard to the care of the prosthesis. It was noticed one day that the iris color of the prosthesis of one of our patients had faded considerably. It then developed that while he had been subjected to some operative measure in the eye clinic, a nurse had put his prosthesis into a basin containing alcohol to safeguard it against contamination. The resin and the cement being soluble in alcohol, fissures into the interior resulted, so that the water colors were leached out of the iris. An acrylic prosthesis should never be exposed to organic solvents.

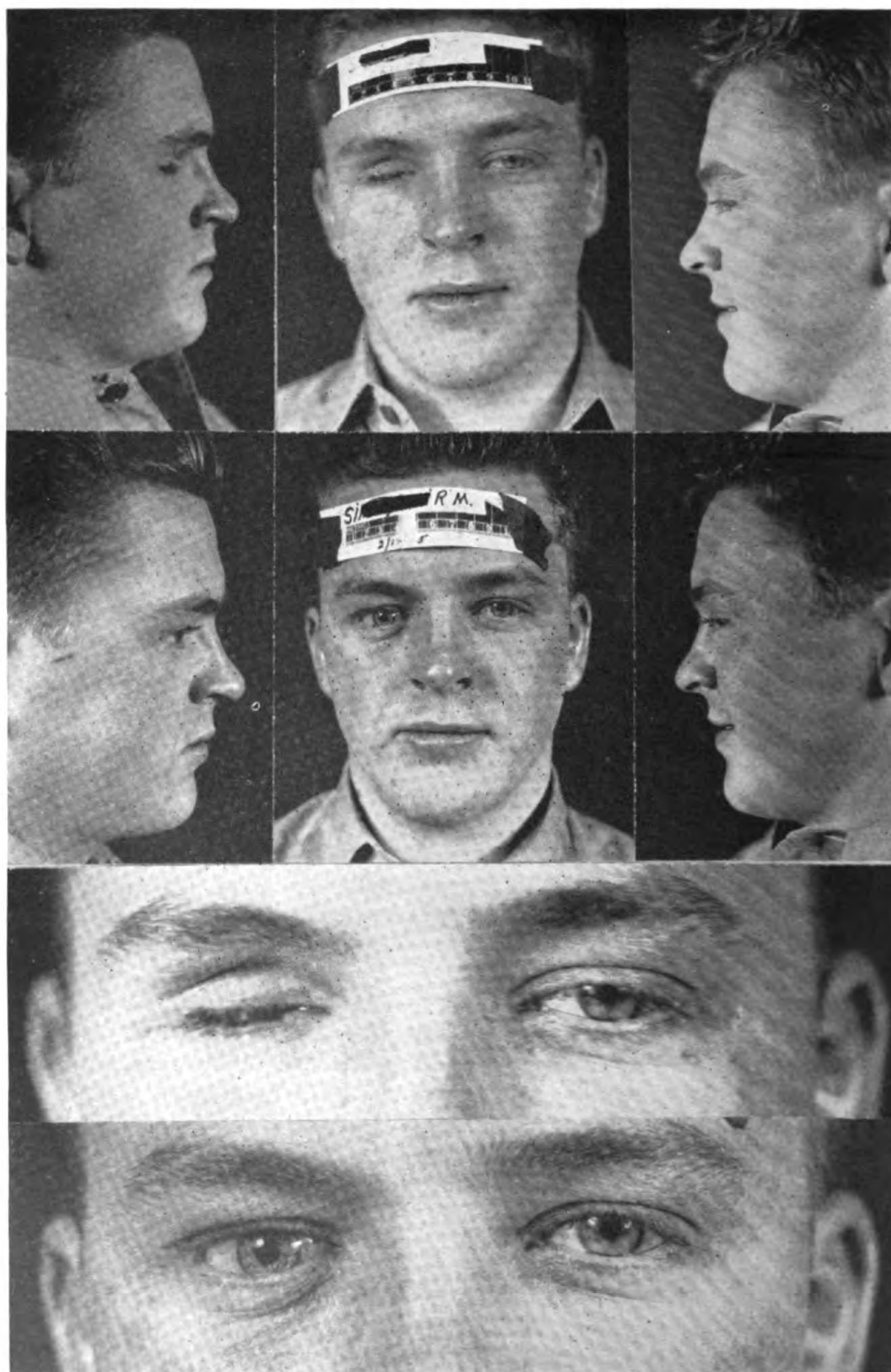
CASE REPORTS

Case 1. (Unilateral replacement).—A 22-year-old Marine, as a result of a land mine explosion, suffered a total destruction of the right eye, which had to be enucleated. The left eye was the seat of a traumatic choroiditis that reduced the final vision to 4/200. A glass prosthesis for the right socket was supplied. However, it proved to be uncomfortable because of the irregular contour of the socket. The patient found the glass eye particularly uncomfortable in cold weather. The acrylic eye has proved a much more satisfactory restoration (fig. 1).

Case 2.—A 23-year-old Marine suffered extensive injuries from the explosion of an enemy antitank shell. In addition to loss of the left leg at midthigh level and of the left fourth finger, he had two fractures and several soft-tissue wounds from shell fragments. One fragment entered on the right side of the head through a small wound of entrance and traversed the head without much damage until it reached the left orbit, where it destroyed the globe and produced a ragged wound of exit in the region of the left orbital margin. The scar is evident in the illustration (fig. 2).

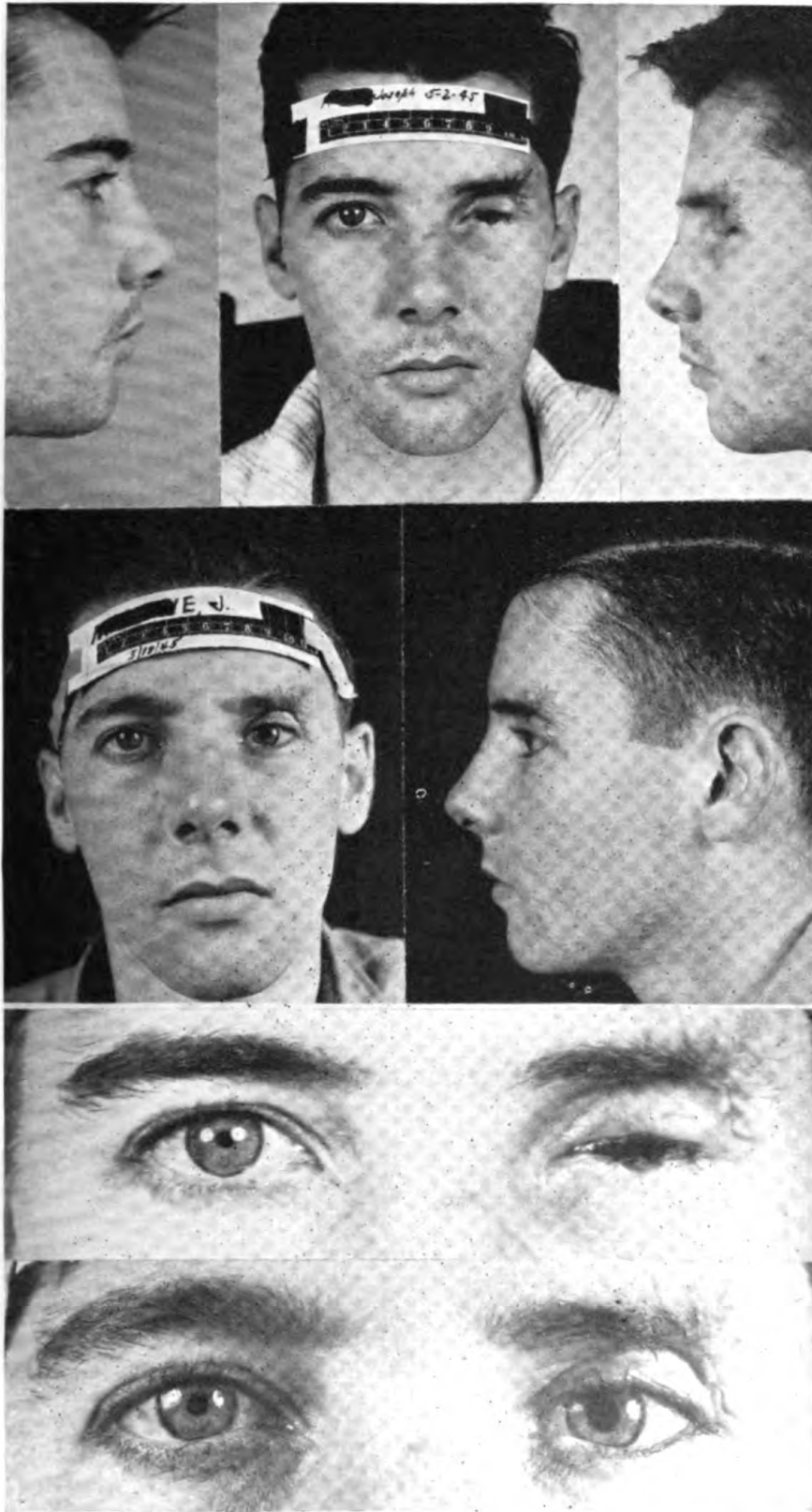
Case 3. (Bilateral replacement).—A 20-year-old Marine was injured on Okinawa in an ammunition explosion. Because of multiple wounds from small fragments, the right eye had to be eviscerated and the left eye enucleated. The excellence of the double restoration (fig. 3) has been commented upon by many of his associates, with a consequent remarkable improvement in the patient's morale.

Case 4.—A 24-year-old Marine was wounded by a hand grenade that destroyed the sight of both eyes. The left eye had been enucleated and there was phthisis bulbi in the right at the time of his admission here. A great improvement in his morale was effected by the bilateral acrylic restoration

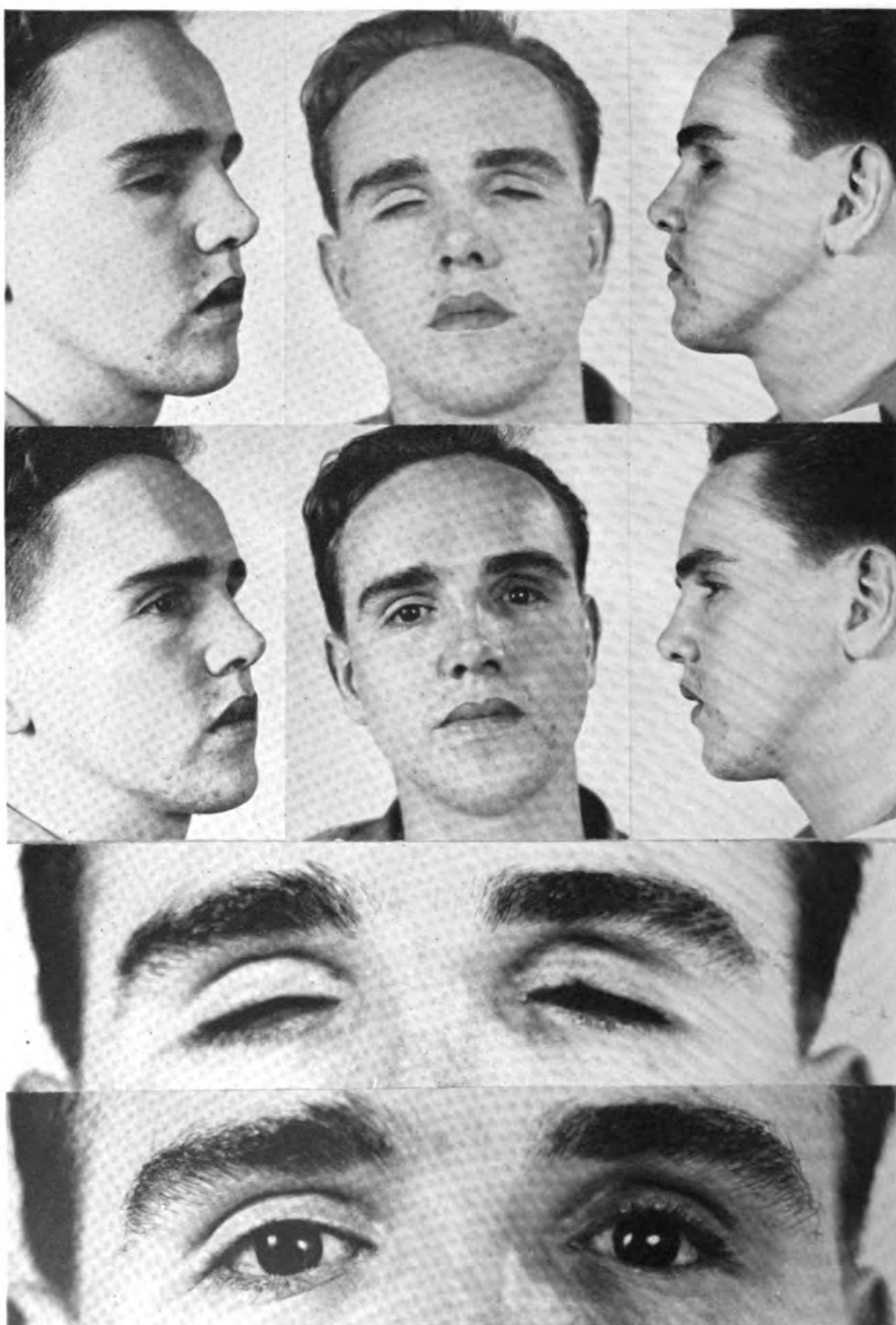


1. Unilateral replacement. (Above) Glass prosthesis, right eye. (Below) Acrylic prosthesis.

shown in figure 4. Attention is called to the motion of the prostheses of which the patient is capable.



2. Unilateral replacement. Acrylic prosthesis, left eye.



3. Bilateral replacement with acrylic eyes.

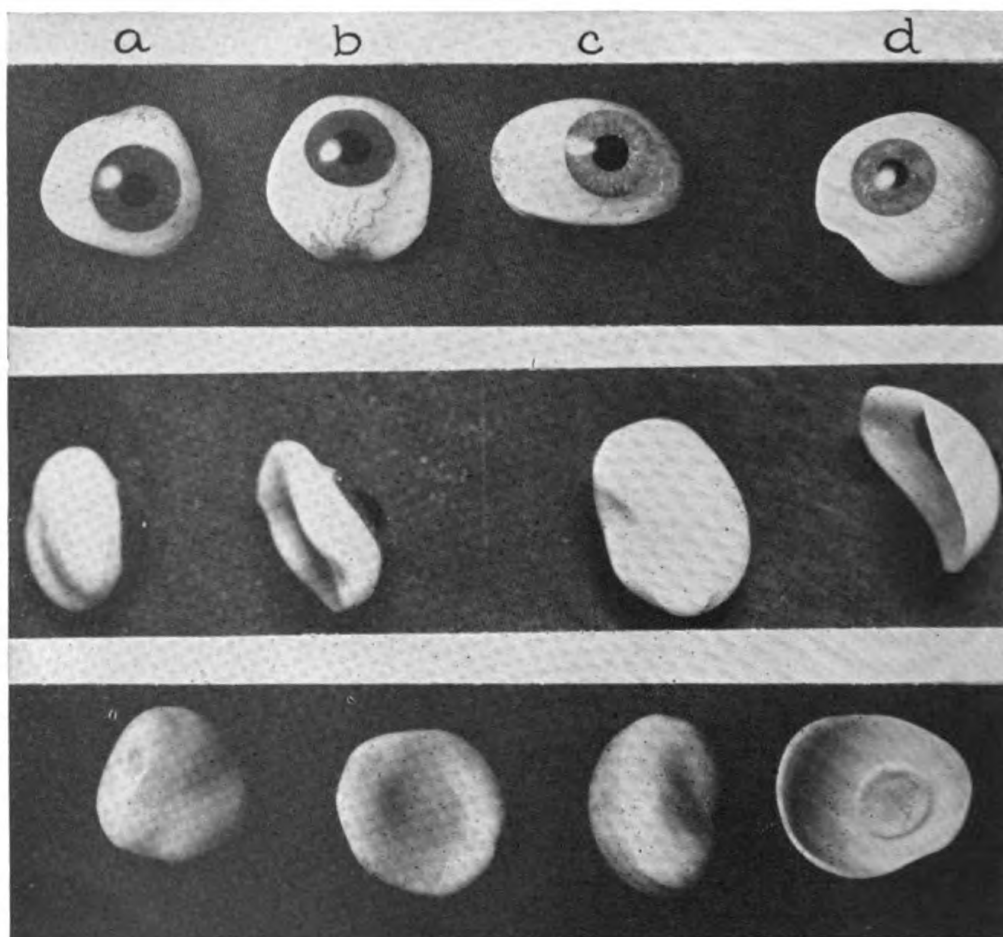
In figure 5 are shown several acrylic resin and glass eyes for comparison. The conformation of the plastic prosthesis to the exact shape of the socket is apparent.



4. Bilateral replacement. Note the motion of the acrylic prostheses of which the patient is capable.

SUMMARY

A report has been presented on the construction and fitting, since December 1944, of a total of 200 acrylic eyes at the U. S. Naval Hospital, Philadelphia, and definitive procedures have been outlined.



5. Acrylic and glass prostheses. Vertical columns 'a, b, and c are acrylic; column d, glass. Note shape of acrylic prostheses, which conform to contour of socket.

Procedures are essentially similar to those instituted at the Naval Dental School, Bethesda, Md., with the exceptions that photography prior to measurement of the iris has been dispensed with, and that in cavities without retentive form, the shape of the mold is altered.

It is believed that the use of plastic materials in eye prosthesis presents several advantages. In terms of restoration, the plastic prosthesis offers lightness of weight, durability, tissue tolerance, and permanence of color. In terms of psychology and esthetics, a successful prosthesis restores confidence and assurance to the patient; even in cases which do not lend themselves to ideal cosmetic results, the reflection in patient morale has been salutary.

The only disadvantage of the acrylic prosthesis seems to be in the rare instance in which the material proves irritating to the tissues of the socket. One such patient has been encountered.

Acrylic eyes must not be exposed to organic solvents, such as alcohol, in which they are soluble.

IV. RE-EDUCATION OF THE NEWLY BLINDED

MARY E. KUGLER

Lieutenant, junior grade H(W) U.S.N.R.

The task of rehabilitation of military personnel is essentially the preparation of a newly blinded serviceman to adjust to a severe sensory handicap, to learn new technic and become acquainted with special equipment and devices, to retrain old habits to meet changing needs, and to bridge the gap between regimented military life and that to which any newly blinded patient may be returning.

Regardless of the stability which the man in service may have displayed, such a permanent physical disability as blindness suddenly thrust upon him requires him to make a so-called sensory revolution. Moreover it demands that he realize the severity of his handicap and accept its limitations. Since the individual guidance given any newly blinded serviceman during his early days of rehabilitation is extremely important, every effort is made to expedite the adjustment of the rehabilitee through a carefully planned program. The principles underlying such a program of re-education and our experiences in applying them to 157 blinded sailors and Marines in this hospital are set forth in this report.

Though generalized in terms of certain habits that are standard, such as walking, reading, writing, dress, personal hygiene, and the like, the program is highly specialized for the individual in terms of intelligence, aptitudes, skills, and aspirations. Some of our patients left school in the fourth grade; others have college diplomas. Each has a program planned to help him realize his potentialities. The mental and emotional upheaval prevalent during the early days of the newly blinded patient's hospitalization is alleviated first of all by the ophthalmologist in charge who outlines for the patient what he may anticipate in medical or surgical treatment.

Introduction to training

The supervisor of re-education explains the program of retraining to the patient, answers his questions, and urges the patient to participate in every phase of the program. Fears are allayed and anxieties minimized through a frank discussion of the limitations of blindness and a positive evaluation of the rehabilitation program for his individual needs.

If a single word were used as a goal for the retraining program, it would be *independence*. To instill in the newly blinded patient the importance of this, beginning immediately, the supervisor of re-education shows the patient a Braille watch and explains how he may secure one for his own use. (These watches are furnished by the American Foundation for the Blind, 15 West 16th Street, New York, N. Y.)

The supervisor of re-education acquaints the patient with the names of the personnel of the staff and schedules interviews with these staff members. All of the data assembled from these interviews are placed at the disposal of all other staff members. Recommendations of the staff form the basis for the plans of the individual program of each patient.

The teacher-attendant

Next comes an explanation to the patient of the duties of the teacher-attendant in his retraining. This teacher-attendant is a trained hospital corpsman who aids him in going from place to place and assists him in eating, dressing, etc., in the first weeks of his adjustment, but who gradually ceases to be an attendant and actually becomes a teacher who makes of each learning experience a rehabilitative process.

The basic re-education of the newly blinded patient is initiated by the teacher-attendant who is both friend and teacher at every level of the patient's rehabilitation. In the choice of the teacher-attendants utmost care has been taken so that intelligent men with tact, patience, perseverance, and emotional stability retrain these newly blinded patients in the care of their person and their possessions, teach them how to eat normally and with ease, encourage them to establish a normal social relationship with sighted people, and with a personal interest assume the responsibility of checking daily on the patients' participation in the program and progress in their habits.

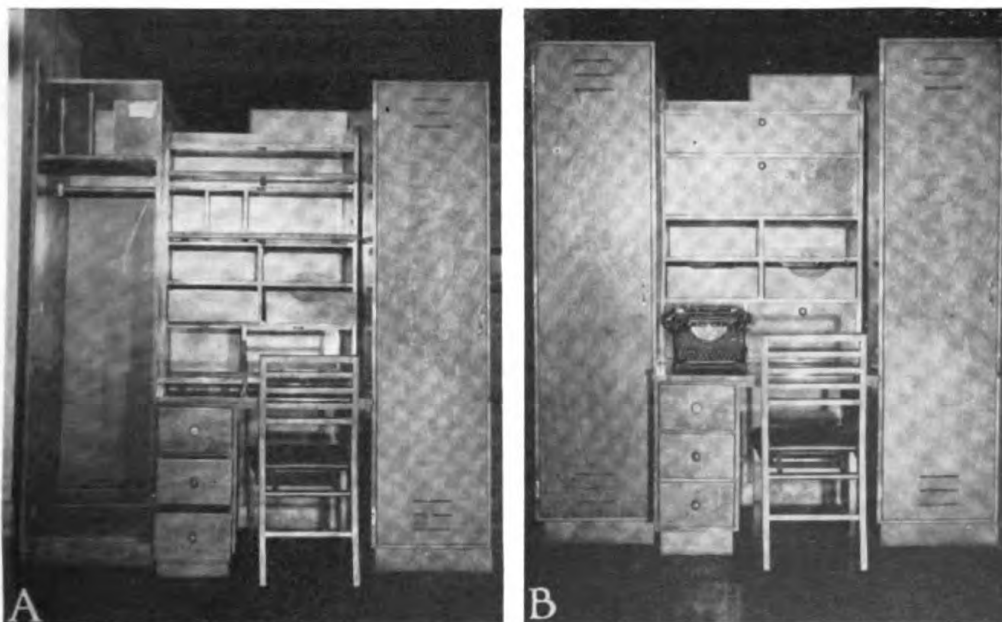
The teacher-attendant guides the patient in productive use of his leisure time by encouraging the use of the talking book, listening to radio programs, record playing, and learning games such as dominoes, chess, checkers, card games, and the dart board. The teacher-attendant reads the patient's mail to him and assists him with personal correspondence. (All patients are urged to type their own letters as soon as their typing proficiency permits.) The importance of the teacher-attendant as a companion cannot be minimized in the early adjustment. These newly blinded patients have undergone a severe shock, and while it is not the attitude of the teacher-attendant to dominate the life of the patient, it is essential that he

provide wholesome companionship in the hospital and at recreational events on and off the compound.

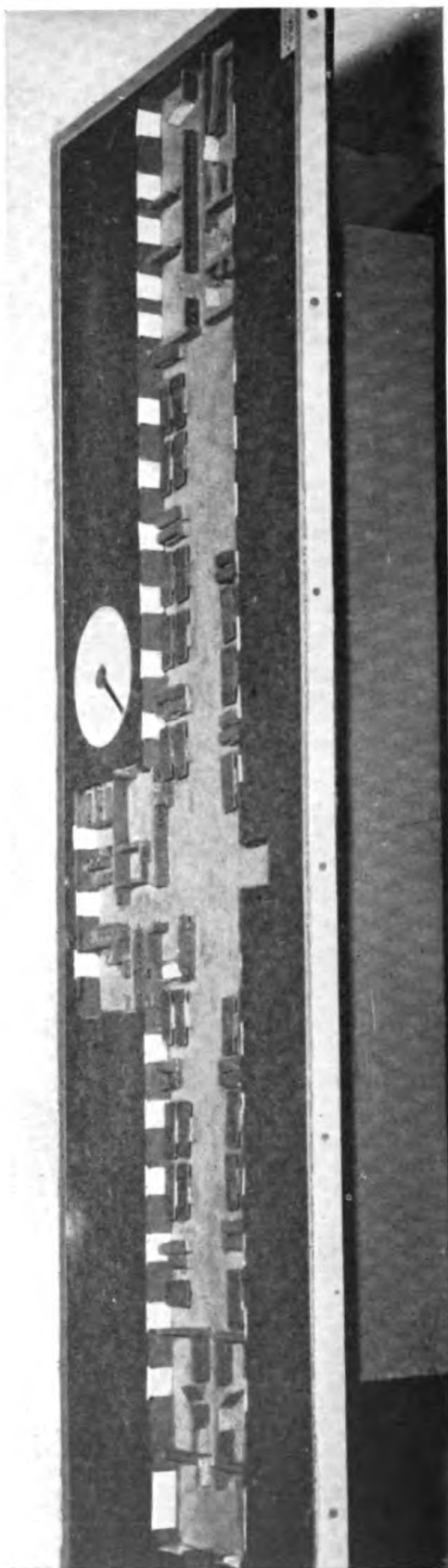
In the anticipation of normal experiences which these newly blinded patients must cope with, the teacher-attendant includes in his curriculum for instruction such things as dialing the telephone, identification of money, identification of clothes, and the ability to carry on conversation in groups or with individuals, with poise and using normal gestures, thereby guarding against blindisms and conspicuousness which these newly blinded patients resent. Again, the man has been encouraged to be *independent* when he has learned to dial a phone, and identify his own clothing. He has also learned the importance of using his memory in everyday activities.

Orientation

The patient will become acquainted with his immediate environment, learn how to choose a cane which is adequate for his own needs, how to move about in the ward and travel in the hospital, in the initial orientation instruction. His first work will be in ward orientation. In giving this instruction, the teacher-attendant accompanies the patient directly to his bed where he gives the patient a general idea of the ward, telling him of the size, the number of patients, etc. He explains the position of the patient's bed in relationship to the others in the cubicle, and the relationship of that cubicle to the entire ward. The patient is assisted in stowing his gear in his locker (fig. 1) and is encouraged to identify and organize it as he does so.



1. Desk locker used on ward for blinded patients. a. Locker open. b. Locker closed.



2. Ward model used for teaching ward orientation to the newly-blinded.

A model of the ward (fig. 2) is used by the teacher-attendant to make meaningful the verbal description of the location of beds, lockers, and doors. By guiding the patient's hands carefully over this model the teacher-attendant can aid the patient in getting a clear picture of his surroundings. The value of this lesson is increased by immediately proceeding to the entrance of the ward where the patient is given a concise description of the location of the ward in relation to the hospital and compound, then is guided by the teacher-attendant through the ward. He is given a careful explanation of the location of classrooms, their use, furnishings on the ward, and especially how they may assist him in moving about freely and unaided. In giving the explanation of the head facilities, the teacher-attendant must teach the patient how to identify hot and cold water faucets and the importance of sanitation.

Since the nurse's desk is located in the central part of the ward, it serves as a base for the patient in orienting himself to the rest of the ward. The teacher-attendant may explain to the patient that very often he may find his relative location by listening for the telephone on the nurse's desk, the water fountain which is nearby, etc. The teacher-attendant teaches the left side of the ward in much the same manner, and then reviews the entire procedure by checking the patient verbally.

In giving this basic instruction in orientation, the teacher-attendant restores the confidence of the patient and also motivates him to become self-sufficient in getting about the hospital as he goes to his meals, to ship's service, the tailor, post office, eye, ear, nose and throat clinic, Red Cross, and others. Much the same procedure is used in teaching the patient how to orient himself to the hospital as was used in teaching ward orientation. Emphasis will be added on such things as how to proceed through revolving doors, travel in elevators, and steps and the use of the cane as an aid in such places. Periodic checking will indicate the needs of individual patients and instruction will be repeated where such a need is indicated.

Eating technic

The teaching of eating is perhaps one of the most difficult and yet one of the most important tasks in the retraining program. Eating itself is perhaps the most difficult thing the newly blinded patient must retrain himself to do in such a way that he may be socially at ease with his friends and his family. Realizing the importance of a normal environment in eating, all ambulatory patients go to the mess hall for their meals where the teacher-attendants serve the patients and eat with them, thus providing a normal eating environment. Instead of using trays, the plates, cups, saucers and glasses are arranged in the conventional way. This is especially important in the man's adjustment since the eating habits he establishes while he is in the hospital are adequate for him in his home or when he dines out.

The food is arranged on the plate in a clock fashion, with the meat being placed at six o'clock and other foods separated on the plate. When this arrangement has been explained to the patient a few times, it is not necessary to repeat it at each meal. A casual announcement of the menu eliminates any unusual table conversation and the patient proceeds with his eating in a normal way.

The importance of good posture while eating is emphasized. The patients are instructed in the technic of meat cutting, buttering bread, and use of condiments.

From time to time, the teacher-attendant will accompany a patient on his liberty and they will have a meal together in a restaurant. This serves both as a check on the patient's progress in the hospital and affords the teacher-attendant an opportunity to teach the patient how he may get the necessary attention from a waiter, give his order, and ask for his food to be arranged in the customary manner.

The schedule

Recommendations of all staff members are combined to form the basis for the formulation of each patient's schedule. A typical schedule might be that of a staff sergeant in the Marine Corps who completed his tenth year of school, and worked in a hosiery mill as a machine operator prior to entering the service. He had no definite plans for the future. His schedule would be thus: 0830 physical reconditioning; 0930 typing; 1030 music (piano or instrumental); 1300 orientation and travel; 1400 Braille; 1500 occupational therapy (work in shop with tools, leather, etc., at first; x-ray film developing, work in ship's service annex, or machine work later, perhaps). In Braille, typing, and music, every effort is made to arrange schedules so there will be few changes of instructors; however in the work with the teacher-attendant it was felt that each patient should work with at least six different teacher-attendants and schedules have been organized accordingly.

The talking book

One tool which many patients have found very helpful during long hours of bed rest following surgery and during leisure, and for which they will find as great a need in civilian life, is the talking book machine. The machine, in appearance, resembles an ordinary record player. The records for this machine are the books he used to read, the classic, the latest novel, or perhaps the Reader's Digest. They are recorded by the American Foundation for the Blind under the direction of the Library of Congress, and with the permission of the publisher of any copyrighted material. Funds to cover the cost of this service are furnished by the United States Government (\$400,000 per annum appropriated by Congress to the Library of Congress).

This hospital has an adequate number of machines for the patients' use and records are obtained from the Philadelphia Public Library, Logan Square. Before discharge from the service, each patient may file an application with the American Foundation for the Blind for a machine and obtain records from any one of the 27 distributing libraries located in various parts of the United States or from the Library of Congress. There is no cost to the patient for the machine, for the use of the records, or even the postage to return the records to the library.

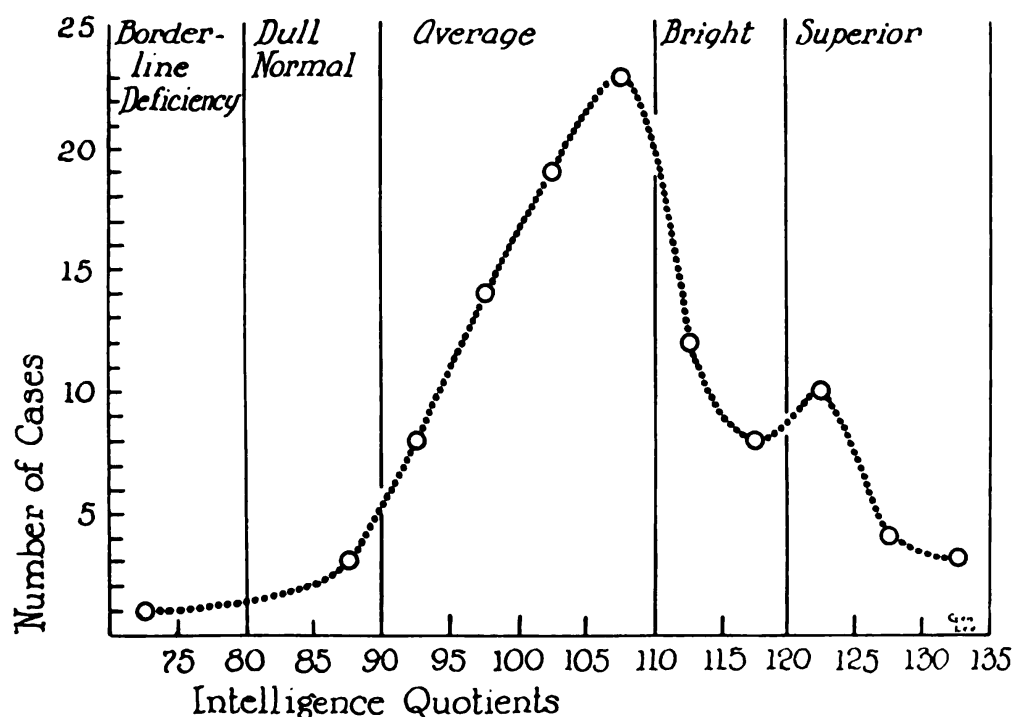
Records of progress

Reports of an individual patient's progress are made periodically and serve as a rating scale in the evaluation of the patient's

general appearance, his ability to travel with and without a cane, his alertness to grasp new ideas in the retraining process, his emotional stability and his attitudes toward his own program. These records often indicate the need for emphasis on one phase of the patient's rehabilitation. An indication of such a need will be noted by the supervisor of re-education and the patient's program is adjusted accordingly. The supervisor of re-education also maintains records of progress and achievement in Braille, typing, physical reconditioning, prevocational experiences, and reports of work done in occupational therapy. During the period of hospitalization, these records form a means of the systematic checking of progress. At the time of discharge they are assembled to form a composite report to be made a part of the patient's permanent record.

Intelligence and vocational testing

The newly blinded patient's adjustment is furthered by spending a period of two weeks at the New York Institute for the Education of the Blind, under the direction of Dr. Merle E. Frampton, principal. Psychologists, trained and experienced in administering tests for the blind, measure the intelligence and mechanical skill of these newly blinded patients. Data are assembled to suggest the direction of the patient's vocational and social interests. The results of these



3. Distribution of intelligence quotients of blinded patients.

tests and the Institute's recommendations are placed at the disposal of the Naval staff. During hospitalization these results aid staff members in planning the patient's program and at the time of discharge these vocational profiles are incorporated in each man's permanent record to be used as a guide for future vocational and educational training.

Psychologic tests administered at the Institute include tests of general intelligence, mechanical aptitudes, manual abilities, vocational preference and, when indicated, tests of social and personal adjustment. To date, intelligence quotients have been secured for 106 patients. One hundred two of these were obtained from the Wechsler-Bellevue Scale and four from the Hayes-Binet. Only verbal scales were used. The mean average intelligence quotients of all those tested has been 106, the range of I. Q's. from 71 to 131 (fig. 3). Mechanical aptitude tests given include those of Wiggly Block Assembly given to 101 testees; Radio Tube Inserting to 70; Matching Forms to 50; and the Playskool Assembly to 10. The Wiggly Block test was most universally given. The subject usually took one of the others in addition.

Table 1 illustrates results of the 110 patients on the following tests given to ascertain manual ability: Minnesota Rate of Manipulation (both placing and turning) given to 65; Detroit Manual Ability to 98; Hand Tool Dexterity to 99; Dual Hand Dexterity (marble dropping) to 77; Miscellaneous Hardware Sorting to 77; Small Parts Assembly to 95; Washer Sorting to 75; Screw and Washer Assembly to 83.

TABLE 1.—*Results of tests for manual ability*

Test	Total testees	Numbers by classification		
		Inferior poor	Low average average high average	Above average superior
Wiggly block.....	101	13	43	45
Minnesota rate of manipulation:				
Placing.....	65	20	25	20
Turning.....	65	10	15	40
Detroit manual ability.....	98	31	50	17
Hand tool dexterity.....	99	20	40	39

Vocational preference tests, per se, were not so widely employed. The Kuder Preference Record was given to 10, the Standard Diagnostic Interview Guide to 27; the Cleeton Interest Inventory to 12; and the Bingham Vocational Interview to 2.

To test social and personal adjustment, the 12 patients so tested were classified on the Bell Adult (Form A) scale.

Prior to the establishment of our program with the New York Institute for the Education of the Blind, men were given vocational tests and study at the 'Trainees' Acceptance Center of the School District of Philadelphia. Their performance on intelligence, manual, and mechanical tests has been included in the survey above. In addition, this Center made use of the Pennsylvania Assembly and Disassembly tests of mechanical ability and Tool Samples I to XI.

Instruction in typing

Another phase of the re-education program includes instruction in typing. Newly blinded patients are readily interested in learning to type. Reasons for this are quite obvious. Typing offers an additional opportunity to become independent. The value of this independence is seen in the personal satisfaction a patient achieves in being able to go into a room, close the door and type a letter without the interference or assistance of another person. Once again a means of normal communication with the sighted world is established.

Systematic, daily typing instruction is provided for each patient, adjusted to his needs, since educational backgrounds of the patients differ greatly. The 47-year-old man whose education was limited to grammar school may require much more intensive drill than the 19-year-old lad who, in addition to being a high school graduate, has studied the accordion for a number of years and whose fingers are quite agile.

No special adjustments are made to the standard typewriters used for instruction except in the case of patients having arm or finger amputations.

In the teaching of typewriting to the newly blinded, the instructor is giving the patient much more than typewriting. The patient must learn to *concentrate*, to combine the manipulative process of striking the keys, returning the carriage, etc., with the mental process of learning key positions, rules for spacing, etc. The combination of the physical process of operating the machine and the building of words, phrases and sentences until the procedure is accomplished with ease requires much supervised repetitive drilling.

The primary aim in the teaching of typewriting is the development of accuracy. Logically this comes about only when the patient has realized the value of the emphasis of correct habit formation and can readily see that speed will be greatly increased by his accuracy.

The touch system of typing, which is now universally used by commercial departments in public schools and business colleges, is the basis for giving instruction. The teaching procedure is started by a careful explanation of the parts of the machine. As the patient learns each, he is encouraged to recognize them by touch and to manipulate

the moving parts of the machine freely. Inserting and removing the paper, setting of the marginal stops, etc., is taught in the first lessons. Good posture is emphasized after an explanation of its importance and how it can directly contribute toward his efficiency in the operation of the typewriter.

In learning the keyboard, the home row is taught first, beginning with the index finger of the left hand. The instructor will direct the patient to type *ffff* space, *ffff* space, etc.

Since with approximately 78 percent of the newly blinded patients, lasting impressions come through the ear rather than the eye, it is especially important that he learn to type rhythmically. When this habit is established early in the instruction period, it expedites learning.

Progressing from the home position, the patient is given simple drills. At first, these are up-and-down drills, such as *frf frf juj kik did*, and others. As the patient masters the keyboard, he does phrases, sentences and paragraphs. Letter writing is introduced as soon as the patient's skill permits typing with ease. Social correspondence is taught first, since the patient's immediate need is to be able to care for his personal correspondence. Later, business forms, the use of the tabulator in making reports, etc., are taught, as well as care of the machine.

The patient receives a typewriter upon the completion of 36 hours of instruction, provided that he has attained a minimum speed of 25 words per minute (additional limitations caused by shell fragment wounds, amputation, etc., excepted) and has a knowledge of letter forms and of the operating technic and care of the machine.

Weekly reports are made by the instructors to the supervisor of re-education. The patient's proficiency is indicated by rating his speed, accuracy, posture, touch, rhythm, and his attitude in general.

Of the 100 patients discharged, 82 have received typing instruction. Of the 18 who did not receive instruction, 3 were discharged before formalized instruction was offered, and practically all of the remaining 15 had mastered typing before being blinded. Forty-six of the present patient group have completed their work in typing or are under instruction.

Instruction in Braille

The actual beginning of the study of Braille, marks, on the part of each patient, the overcoming of a basic psychologic obstacle. It means he has accepted his blindness, and in so doing, is taking one of his first forward steps in his process of rehabilitation. It means he has grasped the value of Braille as a practical method of reading and writing. The Braille instructor must take repeated cognizance that

these all important factors be achieved and maintained by the patient. A primary point of guidance in the teaching of Braille to blinded Naval personnel is the fact that one is working with young adults whose service experience has removed them far from the confining atmosphere of the classroom.

In general the task of introducing Braille to the average blinded serviceman and creating an interest in it on his part is a complex one which requires much patience and skill of the teaching staff. The story of "Whereas I was Blind," by Sir Ian Frasier, has been successfully used to interest students in Braille. Not only must the instructor impress the student with the fundamental intellectual purposes of reading and writing, but also he must be ever alert to the practical reasons for learning Braille. There is an immediate feeling of achievement which each blinded patient gets upon his first successful attempts at reading Braille and the sustaining of this original enthusiasm is the continuous obligation of the instructor. Naturally those men who liked to read before they lost their sight are ready to avail themselves of the opportunity of acquiring the ability to read again. Those who plan to continue their formal education after discharge recognize the value of Braille and are eager to master it.

In addition to embossed books and periodicals, the teachers are aided in creating interest for the student by such tangible objects as talking book records which are titled in Braille and by the Brailled relief map of Philadelphia. Every positive means of motivation is of value, even if it be such a method as telling the recalcitrant patient that a knowledge of the technic will enable him to keep his own telephone list. This, in actuality, was the single point which sold a Tarawa veteran on embarking on the study of Braille. Again the fact that the Braille teacher is working with active young adults may often require that his pedagogy move on radical tangents. Frequently, to keep the patient's attention, the teacher may permit him to advance to an intellectual grasp of Braille which far outdistances his physical ability to isolate combinations of dots by touch. (The mind may be at the high-school level while the finger is still confined to kindergarten.) Gradually this means of motivation will produce a coordination enabling the hand to keep pace with the brain. This type of acceleration was especially effective in the case of a 28-year-old Marine sergeant, whose preservice years had been spent in CCC camps and iron foundries. To him the reading matter incidental to learning each letter of the alphabet in turn seemed childish, and it was, therefore, necessary to allow him to memorize the letters and punctuations of Grade I Braille before he would begin to use his fingers.

Each time the patient's interest tends to lag, the instructor must administer an additional stimulus; the use of the Braille writer always provides a refreshing change-over from the routine reading and memorizing. It affords a satisfaction by leading to an accomplishment which he can perceive. Moreover it is helpful in other ways. By the time the patient has mastered the operating technic of the writer and has written out the alphabet several times, he has usually advanced in reading practice to the point at which he is ready to begin Grade 1½. Used at any time in his course, the writer forces the patient to remember the dot formations for the grade in which he is working. Introducing the student to playing cards with Braille markings is another useful tool, not only to enliven the routine of study, but also to demonstrate the value of learning Braille for purely recreational pursuits.

In introducing a new grade of Braille or further contractions, a check on the amount of material the student could cover in a given time, using the less contracted system compared to the greater amount covered in the same time by using the new grade, provides a point of renewed interest in greater achievement.

It has been found most practical and efficient to give each rehabilitee individual instruction; first because the patient's convalescent period may require surgical and medical treatment which will interrupt the progress of his classes and second because each patient manifests distinct mental and physical characteristics.

The occupational and psychotherapeutic overtones of the study of Braille are a distinct feature in the rehabilitation scheme. Reading Braille is actually a mechanical motor process, a coordination between the fingertips and the brain. On the other hand, a distinct, personal, intellectual satisfaction arises from the accomplishment of being able to employ the tactual senses. Whenever possible the patient is encouraged to read with both hands so that he may acquire speed as well as accuracy. It has been noted in numerous cases where the patient becomes proficient in Braille that his proficiency in other phases of rehabilitation is increased. This may be attributed to the habit formation resulting from drills to improve fingertip-brain coordination.

In introducing the patient to Braille physically, it is helpful to point out the similarity of the entire Braille cell to the "six" dots on the "six" of dominos or the "six" on dice. A brief history of the development of the Braille system may be given at this time. By using the peg board, a simple device resembling a cribbage board with the holes holding the pegs arranged like a Braille cell, the student learns how Louis Braille formed his alphabet by using various combinations of one or more of the "six" dots.

The first 10 letters of the alphabet are the basis for the formation of all the other letters, number sign, punctuation marks, and contractions. In the first lesson, the patient is introduced to the letters "a," "b," "c," "d," and "e." It is necessary that the pupil learn which dots are used to represent each letter. The dots within the cell are numbered down, thus:

1 . . 4
2 . . 5
3 . . 6

It is not only necessary that the student memorize the number of the dots in each letter, but that he develop a mental picture of each. Here again the peg board will aid him.

With the teaching of the letters "f," "g," "h," "i," and "j," the patient encounters some difficulty and confusion. The Braille letters for f, d, h, and j are all corner characters but the differentiation is not easy. There are two ways which may clarify this; both employ association. (1) Call to the patient's mind the shape of the table before him which has four corners. The letter "d" resembles the upper right hand corner, thus: ⠠; the letter "f" the upper left hand corner of the table, thus: ⠡; the letter h the lower left hand corner, thus: ⠨; and the letter "j" the lower right hand corner, thus: ⠰. (2) One may also point out the resemblance in shape of the Braille characters to the capital ink-printed letter, i. e., "D," "F," "H," "J."

While the patient is learning the formation of the first 10 letters of the alphabet, it is essential that he develop certain technics of reading. He must learn to distinguish one dot from two, a vertical line of dots from the horizontal and the diagonal. The sense of touch must be developed. The most sensitive of the fingers, usually the right index finger, should be used by the patient for reading. The large, or giant, dots used in Book I of the Standard Braille Series, are most helpful if not absolutely necessary for the beginner.

Braille is read from left to right as is ink print, and it is essential that the pupil learn and consistently use some technics to keep his place as he is reading. The Standard Braille Series uses "guide lines" to help the beginner get a mental picture in which his reading finger should travel. There are two technics commonly used to keep the place. Both are good. The right-handed may mark the beginning of the line being read with the left index finger. As the end of the line being read is approached, drop the left hand down to the next line and bring the reading finger back to meet the left hand. The left or right handed reader may slide the reading finger from the last word of the line back to the beginning word of the next line on the space below the line just read.

Suggestions that will aid the beginner in reading Braille are: Touching the dots lightly with the ball of the finger; making the point of contact between the finger and the Braille cell as narrow as possible; and sliding the finger from left to right, touching the first column of dots in the cell first. These three technics aid the student in feeling the dots individually in each character accurately and quickly. It also insures smooth left to right reading.

After the first ten letters of the alphabet are learned, the patient should memorize the Braille numbers. The number sign is introduced and it is explained that the first 10 letters of the alphabet (preceded by the number sign) are used to represent the Arabic numerals; namely:

1	2	3	4	5	6	7	8	9	10
⠠	⠠	⠠	⠠	⠠	⠠	⠠	⠠	⠠	⠠

The response to one drill should be and usually is automatic. Practice in using numbers can be given daily in locating the page to be read, in using the calendar, playing with Braille cards, etc. Several patients have seen their first convincing evidence of the value of Braille in connection with their money by merely putting the number sign and 1, 5, 10, etc., on paper money.

The student should next learn the formation of, and be able to identify, the letters "k," "l," "m," "n," "o," "p," "q," "r," "s," and "t." The development of the second 10 letters by adding dot 3 to each of the first 10 letters should be explained to the student. Then practice in the form of oral drill, dot identification, and reading should follow. When the patient is ready, proceed with the last six letters of the alphabet, "u," "v," "w," "x," "y," and "z." These six letters are developed by adding dots 3 and 6 to each of the letters "a," "b," "c," "d," and "e." The letter "w" was not in Braille's original alphabet since it does not exist in French; hence it does not follow logically in the development of the letters. Students will probably realize that the letter "w" is the reverse of "r" and should study the difference between the two letters.

When the study of the alphabet has been completed satisfactorily, the punctuation marks should receive consideration. These, too, should be memorized. The student may be made aware of the relationship between the first 10 letters of the alphabet and the punctuation marks. Generally speaking, the punctuation marks are formed by dropping each of these first 10 letters into the lower part of the Braille cell. It is better to identify each punctuation mark as the patient goes on with his reading, rather than spend time teaching

formal grammar. If the patient recalls his punctuation from sighted reading, few formal lessons on punctuation are necessary.

Reading of the word signs is satisfying, since the rate of speed in reading is greatly increased. When the word signs have been mastered, the Braille contractions may be presented. The study of contractions may prove quite interesting. By pointing out the similarity to shorthand in the use of a sign to express more than one letter, the patient can easily grasp the well-planned organization of Braille, and he is often convinced that it will soon cease to be "dots on a page" and become a useful technic.

Further practice in identifying contractions individually, reading of contractions in words, sentences, and stories is given. For such practice, stories from current magazines or favorite bits of poetry or prose may be used.

The completion of Grade 11½ Braille entitles the patient to discontinue his Braille instruction; however it will be noted many desire to study Grade II. In learning Grade II Braille, the pupil must be aware of the importance of developing technic and memory aids, and of the necessity of constant concentrated practice. The instructor's part, as we stressed in the beginning, will be to maintain interest by providing the pupil with satisfying experiences and keeping the practical functional aspects in the foreground.

Statistics from our program indicate that of the 100 patients discharged, 74 received instruction in Braille and achieved the following level: 7 completed Grade III; 23 completed Grade II; 31 completed Grade 11½; 13 studied in Grade I. For various mental, psychologic, or physical reasons the group of 13 did not complete their work and continue into Grade 11½. It was indicated earlier in this paper that in accepting Braille, the patient has taken an important step in adjustment to his handicap. Some rehabilitees had not made this adjustment during the early stages of their retraining, and it was believed compulsion at that time would be unwise. Several patients labored diligently in the study of Braille and were able to master the mental part but lacked factual ability. Medical officers could determine no physical disability.

Of the 26 dischargees who did not receive instruction, 3 were discharged before a formalized program of instruction was set up, and 20 had sufficient vision, or vision improved, to enable them to read ink print. Forty-four patients are receiving instruction at the present time.

Accurate records of the patient's progress in the form of weekly reports were made to the supervisor of re-education. These reports indicated the patient's speed, frequency of error, posture, touch, and proficiency in use of the Braille writer and the slate and stylus.

The average number of lessons required for acquiring a knowledge of Grade I was 25. Naturally, this number varied inversely with the intelligence of the patient, the more intelligent being able to grasp the 26 letters and the 11 major contractions in fewer lessons. The 23 initial abbreviations and the 17 new contractions which make up Grade 1½ were mastered in a shorter time, on an average in 15 lessons. This was primarily due to the fact that the sense of touch was already adequately developed and the main task now was memorizing the meanings of the contractions. Because there are no new single-cell combinations of dots in Grade II, another month of lessons generally sufficed to make the student proficient in reading and writing the 66 additional meanings and contractions and the 73 abbreviated words which constitute this advanced Braille. In Grade III, which is the most highly contracted form of Braille, no attempt was made toward making a student memorize the contractions and abbreviations; instead he was merely assisted in making his own reference handbook of Grade III. Ten lessons provided enough time in which to complete such a handbook.

SUMMARY

On the whole our program has been characterized by continuous expansion in the quantity of activities offered to the patients. Staff members have exhibited imagination and creative ability in every phase of teaching and retraining. Each patient has been helped in every way feasible to realize his limitations, explore his abilities, and take his first steps in a determined preparation to take a positive, productive and independent place in his home and community life.

The program has essentially given to 157 blinded sailors and Marines initial orientation, basic re-education, general psycho-social readjustment, and prevocational training and vocational guidance. The initial orientation acquainted the patient with his immediate environment through the use of verbal description, relief maps, and a series of controlled and graduated experiences in the hospital, and on the compound. Basic re-education included instruction in basic skills such as the use of a cane, location and identification of objects, personal toilet, the care of personal belongings, eating, posture and gait, and the mastery of Braille and typing. Psycho-social re-adjustment was furthered by group conferences with departmental administrators, and through a carefully planned social and recreational program. Prevocational training followed accurate testing, and vocational guidance encouraged the patient to re-adapt his handicap to previous vocational experience or pursue a training program.

V. OCCUPATIONAL THERAPY

FAITH C. KOCH

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The program of Occupational Therapy for the Blinded at the U. S. Naval Hospital, Philadelphia, was established to aid the patient to readjust and to find new ways of coping with his environment. Primary among human needs is the urgency to exercise some degree of control over one's life and surroundings. Probably one of the most demoralizing fears which beset a newly blinded person is that he may no longer be independent, that is, no longer be able to command his usual degree of control over his environment. Accordingly he must learn to develop to a greater extent the use of other sensory capacities, mainly the auditory and the tactile responses. Much of the work in Occupational Therapy is designed to aid this development of hypersensitivity. Herein are presented the principles, procedures and basic activities of our program for the newly blinded person, as exemplified in the management of 157 blinded sailors and Marines admitted to the Rehabilitation Service in this hospital.

PRINCIPLES

Several specific principles fundamental to the blinded person's task of readjustment may be adduced. Occupational therapy does much to develop manual skills and finger dexterity. For the man who plans to go into a factory or machine shop job, or for the man who wants to be useful about his home or wants to develop certain hobbies, it is essential that he develop some manual dexterity.

Good coordination is another goal of Occupational Therapy. A newly blinded man must learn to combine mental, rather than visual, concepts with action. Elimination of useless groping and undirected movements is important. This is true of any newly blinded person. In the case of one Marine who was completely bewildered because of a severe brain injury, recovery of coordination was a long tedious process requiring many hours of patient instruction. Gardening was first used because of its relaxing effect and because it fosters broad movements. Later the same patient advanced to the stage of intricate lacing on leather projects.

Occupational Therapy aids in exploring the interests of a patient. It may uncover old job interests. It may present new job possibilities,

as x-ray film developing has done for several patients, or it may develop a new hobby.

Occupational Therapy also assists the patient to realize that blindness does not mean incompetency. He learns that there are many complex skills he can master, that many of his previous interests can still be continued, and that he very likely possesses many potentialities of which he has been previously unaware. One blinded Marine, a Texas cowboy, had previously done much leather work as a hobby. Although he could not quite duplicate the type of work he had formerly done, he spent many hours on similar work projects, using a different technic. It is often an advantage for a patient to follow old skills so that he will feel a sense of continuity in his existence. One sailor, formerly a teacher, who required a long period of hospitalization, found that in doing x-ray work, retail stand work, and all types of shop activities, he possessed skills of which he had not previously thought.

Technically, one thinks of occupational therapy as any activity, mental or physical, which hastens the recovery or adjustment of a patient. However in a program so highly developed as the one for the blinded in this hospital, occupational therapy consists chiefly of shop work, wood work, and certain types of prevocational training. It may serve as diversion, for retraining, or as an introduction to vocational training.

Procedure

In most instances, the therapist's work began as soon as the patient had completed interviews with the Educational Services officer, the occupational therapist and the supervisor of work experience. A plan was laid out for his prevocational and vocational program. His interests, former occupations, education, and future plans were discussed in detail. The patient was then acquainted with the various shop activities from which he might benefit. He was encouraged to experiment with a variety of skills both familiar and unfamiliar.

For bed patients or those requiring extensive surgery, the therapist began her work on the ward. It was important to the morale of the patient that some form of activity begin early. During the hours of long, quiet waiting before the patient could enter into a full day's program, it was most important that his thoughts and activities be directed positively. Diversional therapy during this period was necessary.

A wide variety of activities is essential. In the first place, one has a highly varied group with which to cope: Farmers, college professors, factory and clerical workers, students, stevedores, and many others. To find some means of self-expression for each requires

ingenuity and a diversity of facilities. Adjustment always remains an individual problem. Second, variety is necessary because one is attempting to do a complex job—that of exploring the patient's interests, developing his skills, coordination and sensitivity, introducing prevocational interests, and perhaps developing a hobby.

Leather work is particularly useful. Leather is traditionally masculine; in addition it appeals to the tactual and olfactory senses, and is therefore of special value for the blind. A first project, the construction of a link belt, for instance, is very simple and is accomplished in half an hour. Thus it never discourages the awkward and hesitant beginner. Success on the first venture is, of course, very important in order to establish self-confidence in the newly blinded.

One Marine, married and with a family, found considerable satisfaction in the hope that while attending college he can, as he says, "always make a few dollars on the side with leather wallets" if he needs to supplement his subsistence allowance. Another Marine wanted to continue leathercraft as a personal hobby. He prepared a set of patterns for a wide variety of items and has obtained the necessary tools. These products he expects to sell in connection with a roadside tourist camp and gas station.

Moreover leathercraft provides a definitely graded type of activity. Heavy materials and large simple projects, such as moccasins, are suited to the patient with little mechanical skill and undeveloped tactile sense. As he becomes more adept he can undertake intricate projects, using fine materials. Patients find that the holes used for lacing are similar in touch to the dots used in Braille. With little practice, attractive items suitable for gifts to members of the patient's family can be made. Not only does the patient gain satisfaction from doing something for others, but also the recipients gain concrete evidence that a blinded person can do useful work. And not least in importance is the fact that the patient participates in an activity very popular with sighted patients in the hospital, and gains experience in competing with the sighted world.

Woodwork is useful, practical, and develops mechanical skill. Often the patient has had previous experience in a school shop, on a job, or in repair work about the house, and continued practice in woodwork enables him to continue his role as handy man about his house.

Ordinary hand tools, with simple adaptations, are used. The blind do their own measuring with notched rules and squares. A triangular file, or a marking awl traced about a pattern provides guide lines for cutting. Special technics in hammering and sawing are explained.

Although blinded patients do not set the type, some enjoy using the hand press. Hospital forms and franked envelopes provide use-

ful occupation. Personal letterheads and printed envelopes appeal to the patient as tangible evidence of a way of helping himself.

Some experience in gardening is recommended, particularly for those interested in outdoor work or for those who come from farms. Ordinary tools, especially adapted for the blind by a former instructor of Columbia University, have harness snaps welded on the various pieces. These are clamped on a taut wire stretched between metal stakes which can be moved from row to row. This arrangement allows for accurate spading, planting and cultivation. By allowing his ankle to follow along the wire as a guide in the early stage of planting, the patient can avoid stepping on other rows. Complete sets of these tools are given to patients who desire them. Aside from its practical value, gardening produces a very excellent therapeutic reaction.

The patients who seem to have gained the greatest benefit from this work were those who found it most difficult to adjust to their loss of sight. A Marine who had a severe head injury along with his loss of vision seemed to be lacking coordination, and was confused and unable to orient himself as to space. Working out of doors seemed to release much tension. Gradually he was able to work longer periods of time. Then he became accustomed to short periods in the shop and was able to handle more intricate tasks. Another patient who was under the care of a psychiatrist for some time, found gardening helpful in releasing some of the tension which stood in the way of his final adjustment. It has often been found very helpful in providing an outlet for emotional stress and strain. It also furnishes the genuine satisfaction of seeing things grow as a result of one's own efforts, and is an excellent escape from hospital routine and atmosphere.

Power equipment is especially useful for those who intend to follow some industrial line of work. The drill press is probably the most practical power tool for industrial use by the blind. Consequently, projects requiring the use of this instrument are introduced to the patient. Safe and easy to control, it gives self-confidence in the handling of a power instrument.

A Marine blinded on Saipan, who had formerly done sawmill work, roofing, and carpentry as his trades, found much satisfaction in constructing a shop partition, typing tables, and file boxes. Finding new ways of using familiar tools and using power equipment gave him a new lease on life. Shop work was followed by experience in an aircraft factory and a job in a marine hardware plant. The entire experience demonstrated to him both job possibilities and the ability to do maintenance work around his own home.

Other power tools commonly used are the power sander, the emery wheel, and the buffer. Kitchen knives made from heavy hacksaw blades are popular projects for the emery wheel. Rings and bracelets of deck steel, hand-sawed, are polished on the buffing wheel. Here, as with the drill press, the experience with powered equipment is probably more important than the projects themselves.

Metal bracelets and necklaces of coiled silver wire permit the more adept patients to develop their dexterities. Hammered metal projects, which depend entirely upon touch for accuracy, promote tactual learning.

Plexiglass projects encourage use of the foot-powered jigsaw, the coping saw, files, and drills. Plastic material, like leather and wood, appeals definitely to men. Again, the end result is the development of sensory learning, coordination and skills.

A Link trainer, formerly used for training aviators, has also proved to be of some value to blind patients. It aids in developing a sense of direction. Aside from this practical value, it is just plain fun to a boy's way of thinking. For a few patients who have had experience in aviation it has particular appeal. The trainer used by blind patients has had most of the instruments removed, leaving only the stick and foot pedals to be manipulated by the patient.

Weaving is another project offered patients if they have an interest in it. Perhaps a man has been a millworker or comes from a rural area, or is of foreign parentage where weaving has been a household art, or perhaps he has had some experience with it in camp work. There have been several cases of collateral arm or hand injuries which make some activities impossible; in these instances weaving is a satisfactory project because the end results can be worth while to the patient and because the method secures results quickly.

A sailor who had lost his left arm and who had never done any intricate work, having been a stevedore, found weaving rugs for his wife a genuine satisfaction in the early part of his program. Later when he became more skilled and self-confident he cooperated successfully in all types of shop work and worked in the retail stand. One obstreperous young Marine, who was extremely negative in his attitude, found weaving interesting because it had been a household art in his family. In these and other similar cases, weaving is encouraged. It is not stressed with most men, since it is felt that the average sighted man would probably not develop such a hobby.

Other miscellaneous projects are included to meet the needs of individual patients. Among these are work in code, elementary electrical wiring, motor repair, puzzle making, cords for bows used in archery, leather braiding, macrame knotting, bicycle repair, and

greenhouse work. Most of the traditional shop activities for the blind, such as basketry and broom making, are never used.

X-ray film developing is a new venture for the blind that has proved successful. Experiments have been carried on through the efforts and suggestions of the officer in charge of x-ray service. Since this work is done in a dark room and is timed, no sight is necessary for the job. Braille markers on film racks and matching marked envelopes for the film are used. The blind technician uses an ordinary timer with the face covering removed and the numbers marked with dots. After the film is processed, it is hung on the rack to dry overnight and the following day films are replaced in the matching envelopes.

This project is particularly good in building up morale because the patient knows that he is taking over the job of a sighted person. It is a good example of the independence the blinded strive for. Not only does this activity have prevocational value, but also it teaches a patient to conform to a scheduled job. At present, three hospitals have employed these technicians. One of the best x-ray departments in the country is now operated by a patient trained in this hospital. He instructs other technicians as well as does the developing. Another discharged patient instructs technicians in a New York hospital. One of the present patients is combining training in typing from dictaphone records with x-ray work, with a view to returning to his former employer, a large railroad company, as a technician in the company hospital.

A stand, a subsidiary of the ship's service store, is operated for the benefit of those interested in retail service or a business of their own. This project is in charge of a hospital corpsman with extensive experience in operating a store. The stand provides training for six patients per day. The first three days are used in learning to operate the cash register. No bills of more than a dollar value are accepted by the blind clerk. Patients are extremely accurate in making change; in 1 month's business of \$3,200 there was a discrepancy of only 95 cents between cash on hand and register figures. For the first 5 hours the patient does not receive any pay, as this is considered necessary apprenticeship. Following this he is paid at the rate of 40 cents per hour.

Daily time in the store for each varies from 1 to 3 hours. Three weeks' experience has been found to be a minimum time necessary to give a man a good over-all knowledge of the business. For those who have done advanced Braille work, there is an introduction to the system of bookkeeping. Stock is replaced in the store daily from the storeroom; about 110 items are handled. The store operates with

a running stock of \$500 and does a daily business of \$150 to \$200 during 5 hours each day. Not only does this training have definite therapeutic value, but it is an excellent prevocational training activity because of its usefulness in any locality.

A Marine from the Middle West who had two children and a wife could not be reconciled to the loss of sight, largely because he could not go back to his family with an adequate means of support. Pride would not permit him to depend on a pension. He rejected all suggestions and all attempts to get him to follow the rehabilitation program. When the stand was put into operation, however, he was anxious to be the first one to carry on the experiment. It seemed to him to be the ideal solution, since there were several industries in his home town in which stands would be very practical. Also the possibility of a small private business seemed to be a solution to his problem. His work in the stand was excellent. His entire attitude and outlook changed almost immediately. His appearance improved a great deal, because he felt the need to be well-groomed when meeting the public and because of his improved morale. Whether he finally goes into this type of work is not yet certain, but in the meantime it has been a temporary constructive solution to his problem.

A Marine from the same area who, on his first interview, had expressed a plan to go into business was given a chance to work in the shop. He felt that this was possible since an uncle who was blinded had been quite successful in a business of his own. The patient worked several hours daily, learning to operate the cash register, take inventory, replace stock, and keep records. He developed to the point of being able to operate the store without supervision. This experience proved to him that this was at least one way in which he could earn a livelihood.

Adaptation of maps and games, other than checkers and dominoes, is also the work of the Occupational Therapy Department. Braille relief maps of the city and the hospital help in the orientation of the patients.

Of the total of 157 patients, about 83 percent participated in Occupational Therapy. The amount of time varied greatly. One badly adjusted Marine, unwilling to cooperate to any great extent in other phases of the program, spent practically the entire day in the shop. Others spent only a short time. An hour daily was recommended for almost all patients. The following figures give some idea of the activities preferred: Leather 95 percent; woodwork 25 percent; stand operation 20 percent (not available in early part of program or it would be a higher percentage); x-ray 10 percent; weaving 5 percent; gardening 8 percent; metal 6 percent; miscellaneous 20 percent.

SUMMARY AND CONCLUSIONS

Occupational Therapy has played a part in rehabilitating most of the 157 blinded patients admitted to this hospital. Its method varies with different patients but always it serves as a stimulus to aid the patient by his own efforts to return to normal patterns of life and expression. His program aids in developing tactile sense, improves manual dexterity and coordination, develops hobbies, or starts pre-vocational training. A wide variety of activities is offered in order that individual needs may be satisfied. The product itself is important only as a means to an end. The important consideration is that both the patient and his family have evidence of his ability to maintain his independence. Occupational Therapy offers many concrete examples of this accomplishment. Patients are always urged by the therapist to participate in all phases of the program in order that their adjustment will be well-rounded. Education or additional vocational training is urged so that the patient may be prepared for a specific job in the future.

The program of Occupational Therapy is planned to aid the newly blinded individual to readjust and find new ways of establishing his independence. The objectives of the program and ways of accomplishing them are described, and methods used are explained. Activities, and cases of practical application, are discussed.

VI. OUTSIDE ORIENTATION AND PHYSICAL RECONDITIONING

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Correlative with the general program of physical education carried on at this hospital, certain special features of the department's efforts have been designed to contribute to the rehabilitation of the newly blinded service personnel. To this end the staff of physical education undertakes a twofold contribution; it assumes responsibility for training in *outside orientation* and, through a carefully devised array of calisthenics, sports, and games, promotes the *physical reconditioning* of blinded patients. The principles governing these two elements of work with the blinded are outlined in the discussion that follows, and the programs are described in some detail, in the hope that our experience in dealing with 157 blinded sailors and Marines will prove salutary in the further development of these special aspects of physical education.

OUTSIDE ORIENTATION

Principles

Outside orientation for the blinded is considered to be one of the most important phases of their re-education. We have attempted to set up a progressive series of lessons which will enable those with defective vision to get about outdoors with safety and as independently as advisable, and to provide adequate practice in the fundamentals involved.

We have determined, through past experience, that 14 hours of instruction is the minimum amount of time required to teach the essentials of outside orientation properly and to enable the patient to pass the four basic tests included in the curriculum. Perhaps the most important requirement for successful performance is the desire of the patient to learn. Intelligence and alertness to his environment are probably the next most important attributes. Ability to reason, sensitiveness and a good memory certainly aid the student in making rapid progress. Proper equipment, especially the cane, is very important. *Confidence* in one's ability and *care* make a good combination. These two together with *concentration* make the three C's which a totally blind man who has travelled alone successfully for many years relies upon in teaching blind students to get around.

Withal that these are general requirements, however, it goes almost without saying that each man must be treated as an individual.

RETRAINING COURSE

Each student is contacted as soon as his name appears on the Outside Orientation schedule. The instructor gets acquainted with the student and makes the necessary arrangements for the first lesson. At the start of the session the Talking Book Record, "An Open Letter to My Newly Blinded Friend" by Joseph Clunk, is played and discussed. Also at this time the student's cane is checked and changed if advisable. It is generally agreed that a long cane has many advantages over a short one, but the attempt to make a substitution for the student's favorite short cane usually leads to long arguments. After a careful demonstration and review of the advantages of a long cane, however, the student usually consents to give it a try.

The first test demands that the students leave the ward, go out the east gate to the corner of Broad and Patterson Street, a distance of 200 yards, turn the corner, walk for a short distance and return. Each part of the route is carefully explained and discussed with the patient and he is shown how to use his cane when travelling an unfamiliar section involving steps, curbs, holes, and fences. This method requires that the tip of the cane touch from 3 to 6 inches ahead of the spot that will be reached with the next stride. When the left foot is back, for example, the cane is swung to the left slightly ahead and to the outside of where the left foot is going to step, and then as the left foot comes forward the cane swings over to the right and touches lightly several inches ahead of where the right foot will be placed. This entails an unusual coordination between the arms and legs in walking and must be learned through practice. If the elbow of the cane arm is held fairly close to the side, it will help to overcome the tendency to bear to the opposite side. This tendency is brought about in several ways. If the right shoulder is forward even slightly, the shoulders will turn to the left and the body will tend to follow. The cane swings in a longer arc to the port side and the student will reach to the left because of it. Then, too, most people take a slightly longer stride with the right leg, causing movement to the left, and so accounting for their walking in circles when lost in woods or desert.

The cane may also be used to advantage in getting about over familiar ground where curbs, holes, sidewalk elevators, etc., are not present. This method is simply the holding of the cane diagonally across the body with the tip an inch or two off the ground in front

of the left foot and several inches outside the body on the other side and with the handle turned forward to protect the fingers. At first the student will hold it out farther than necessary but will gradually allow the cane to come closer to the body.

From the beginning the student is reminded to use all his senses to aid him, and to think and reason clearly. He is taught to pick out certain landmarks such as fences, gratings, etc., to aid him on his return trip. Sun, wind direction, trees, gravel, buildings, traffic noises, and numerous other factors will help if they are noticed and used.

The number of lessons required to pass the first test will vary with the student, but will need at least 2 hours. Confusion is caused if too many new points are given at one time, so that several trips over each course are advisable.

The second test involves taking a public bus to a residential area nearby, making a circuit of the block and returning to the ward. The experience of getting on and off the bus is new, as well as many other experiences encountered in the residential area. Standing at the bus stop so that the driver will notice the cane usually means that the bus will be stopped directly in front of the student. Types of buses and number of steps involved can be learned by listening to the sound of the engine and the rattles. The student learns to approach the driver to make change and inquire if there is a vacant seat nearby as well as to indicate at what street he would like to alight. Invariably the driver and other passengers see that he is settled properly and not pitched into someone's lap as the conveyance starts up.

At the area itself ordinary difficulties are encountered. Children may be playing on the sidewalk and cause confusion with their usual curiosity and remarks; other distractions consist of curious pedestrians, trash cans, hydrants, poles, broken pavement, projecting steps and the like. The student learns to meet these obstacles and to cope with various situations. The course is covered in both clockwise and counterclockwise directions, for each presents different problems. For example, the curb may be used as a guide when travelling counterclockwise, whereas a very irregular line of steps, hedges, and buildings is encountered in the opposite direction. Constant review is necessary before each point is properly mastered.

During the practice on this second course, the student usually finds that he can get along without the sound caused by the metal tip on his cane and a sliding rubber tip was devised so that a quick change could be made. One of the students was mainly responsible for the method finally used.

The third test is centered in a combined residential and business area, involving a stop light, and various stores. Crossing the street at this intersection necessitates help from passersby. If help is not offered, as is often the case, the student is taught how to approach pedestrians for assistance in crossing. The flow of traffic is noisy and difficulty is encountered in telling whether fellow pedestrians are nearby or not. A word picture of the course is given to the student during the first trip. This is usually general in nature and no effort is made to remember details. Various places of business are referred to in passing, particularly places which have a distinctive odor or noise such as a diner, taproom, barber shop, fish market, fruit stand, gas station, or garage. There are several awnings in this area which come down very low and are dangerous to the blind. A soft hat may be worn in civilian life to give a little warning of overhanging obstacles.

After the first trip is made over the course, the student is put on his own, with the instructor keeping some distance away. Questions may be asked to clear up a point in question, and signals between the instructor and student are set up to be used in case of danger. "Go easy" is the signal used to warn of possible danger and means to go slowly and investigate thoroughly. "Easy" is used to warn of immediate danger, and means to stop instantly. These words were suggested as they were not likely to be used by others and they still convey the thought desired. Mistakes are corrected on the spot if advisable and suggestions are made from time to time. The student must pass the test on this course with a high grade, as it includes virtually all of the fundamentals required to get about in the ordinary city.

The fourth and final course includes the subway, and the heavy traffic of downtown Philadelphia. The student is given the subway course because it adds turnstiles, cashiers' booths, unusual confusion and noise, and the use of escalators to his other experiences. The turnstiles are particularly difficult as they do not click as they turn and give no warning as to whether or not they are spinning. The escalator can be picked out by its sound and, if investigated with the cane before stepping on, there is usually no particular difficulty. To get off at the top, the student is taught to stand still until he slides forward onto the grating, then step forward.

The student is not expected to negotiate the difficult subway procedure by himself and is cautioned to seek aid. There are some blind people with years of experience who do make use of the underground but it is not recommended for the beginner. The heavy foot traffic on the street near the City Hall together with the very broad sidewalks makes getting around both easy and difficult, easy because

there is always plenty of assistance around, and difficult because of the lack of markers and the usual guides for keeping the line of direction. Again the number of trips necessary will depend upon the student's reaction and ability to fathom the confusion and noise. Some are excused from this particular course when it seems advisable because of other injuries. If this is the case, then additional time is spent on previous lessons.

Sensitiveness

Several of the blinded patients have suffered some degree of hearing loss, while others possess an insufficient olfactory sense. Such additional losses constitute a further handicap. Those with defective hearing experience some difficulty in walking; they invariably bear to the side of the poorer ear. The reason for this is obvious; the head is turned with the good ear forward with the result that there is a positive tendency to lean to the other side. Once a patient realizes this tendency, he can do much to correct it, although it has been observed that he will continue to have difficulty. A blinded man without a keen sense of smell has additional difficulties. Countless numbers of physical objects, places of business, various districts and the like, have distinctive odors, and the ability to rely upon recognition of them is a considerable asset in getting around freely.

That hearing and smell serve us as guides is often taken for granted by the sighted person in everyday life. The blinded man never takes such sensory cues for granted, a state of affairs that has given rise to much psychologic speculation and experiment in recent years. One of our patients in particular was very successful in using his excellent hearing in ascertaining the nearness of objects. Sounds from his cane and his heels were heard in various tones for different objects. By dint of excellent reasoning he could determine when he was under a tree, approaching a building or passing an object with a sizeable surface. Nor is this psychologic magic. When a blinded man is aware that he no longer feels the warmth of the sun, can identify the coolness of the shade, and, moreover, is actively oriented to his general position, it requires only clear deduction for him to conclude that he is standing under a tree. Several other patients have indicated that they make use of the so-called "facial perception" in discerning doorways, for instance. This usually means that they are employing their hearing and their sensitiveness to changing air currents in their environmental "findings."

These possibilities are presented to all patients during their orientation periods, and they are urged to develop their perceptions in their own ways. One very young patient, for instance, totally blinded, possessed a negligible sense of smell but demonstrated that he could

distinguish the slightest change of pitch as his cane tapped the sidewalk or street. Such an ability, evidently "natural" to him, can be developed into an invaluable asset. And incidentally he possesses a sense of humor sufficient to carry him over many bumps. This particular "sense" is perhaps too tenuous to warrant casual discussion; suffice it to say that those of our patients who have it are much more resilient and have a much easier time in their difficult task of learning outside orientation.

Intelligence

It must be assumed that the factor of intelligence is central in the task of physical adjustment to blindness. Of all human attributes this is perhaps as important as any other to the newly blinded man who is learning to control his movements and master his environment. Our experiences with various intelligences has been extensive and not always happy. One instance comes to mind, however, that suggests a not infrequent state of affairs. A Marine on an orientation trip encountered a pole set in the sidewalk. Since every man is encouraged to investigate thoroughly any obstruction for whatever information may be gleaned, he immediately went to work. He knew at once that it was metal and that its ring on contact with a cane was different from that of a trolley-pole. By direct contact he determined it was a gas-light pole, and observed that it was in the middle of a block. Upon being asked how he knew it was not on a corner, he replied that electricity was used for light at intersections in the outlying districts of Philadelphia, and gas in the center of the block. This is applied intelligence in outside orientation.

PHYSICAL RECONDITIONING

Principles

Physical education for the newly blinded at this hospital has many aims. All patients had already undergone a strenuous conditioning program shortly after entering the service, and combat duty maintained that condition. However their wounds and subsequent hospitalization left many in not only a poor physical but a poor mental state as well. Some lack good coordination, have a fear of physical contact, and cannot balance properly. Familiar recreational activities must be dropped or adjusted somewhat and new ones learned. In order to foster both psychologic and social needs, sports should be undertaken which are enjoyable and group games should be stressed whenever possible. Self-confidence must be restored and independence regained. A properly organized physical program conducted by well-trained, intelligent and understanding instructors can greatly

assist in carrying out these aims. The total or partial loss of sight will naturally lessen normal physical activity and most people so affected will just remain inactive, even though not forced to do so of necessity. Poor circulation and digestion and sleepless nights are the result, with subsequent lassitude, ill-temper, and lack of cooperation.

Activities

The type of program developed will vary somewhat with the climatic conditions, and both indoor and outdoor activities must be used in most localities. The outdoors is easily the better of the two. Plenty of fresh air and sunshine with pleasant surroundings aid greatly in the rehabilitation of all patients. *Formal calisthenics*, while genuinely disliked by most patients, can be given so that they are not too monotonous. Some fun can be injected by the leader in such a manner as to make the exercises seem less difficult and to keep the patients' minds occupied. The same instructor should give the work each day. This is very important in working with the blind. They become used to his voice, manner, methods, and directions and soon learn to have confidence in him. Even though the identical exercises are given by another, the same results do not obtain.

Not all physical instructors can handle a blind group easily and well. Whether it is his voice, the way he gives the commands or some other trait, is not known by the writer. That he must be sincere and have more than a general interest in his class is certain. Extreme care must be taken in giving directions. They must be clear and well planned. Such common terms as, "in this manner" or "I will demonstrate," obviously cannot be used and even an occasional slip will cause loss of standing with the group. Assistants walking among the class can be of much help to individuals who have difficulty with balance and coordination. Manual assistance is sometimes necessary but should not be used too often. The newly blinded man likes to do things independently and often resents even the slightest aid.

The classes should be small, not over a dozen or fifteen, and its members in about the same stage of progress. This is advisable in order to grade the difficulty of the balance and coordination exercises. Deep knee bends are impossible for many at the beginning, yet by graduating the exercise over a period of several weeks from a quarter bend and so on down a little more each week it can be accomplished by most patients. Moving the arms in small clockwise circles, while held in a sideward raise position palms up, is very difficult for some at the outset. It can be noted, however, that men who had exceptional previous skill in sports are not affected as much as those whose former skill was only slight.

Good posture can be brought about through calisthenics more easily than by any other way and this should be stressed during the exercise. Most newly blinded will develop a forward bend of the head and kyphosis arcuata if not corrected at the beginning. If correction of this tendency is made daily during the exercise period as well as on hikes and outside orientation, the patient will soon walk and carry himself in a good position. General muscle-tone is increased because of these exercises, which aids materially in maintaining good posture. Lastly the warm-up for other more strenuous activities later in the period is valuable to eliminate the possibility of a strained muscle.

Medicine-ball handling, conducted in a closed circle, is excellent, particularly for new patients, for overcoming fear of body contact as well as for promoting group activity and sociability. One or two balls may be used with a change of direction made on signal from one of the instructors who is a member of the circle. Competition can be developed by trying to see who can continue the longest without dropping the ball.

Tug-of-war is an excellent contest for developing team spirit and cooperation. Then, too, it gives a strenuous workout in a very short time. Contests with sighted groups of equal weight can be arranged. Nothing pleases the blind more than to win over a sighted team in any contest. It gives them a feeling of being anything but helpless, and capable of doing things well in spite of their handicap. Let me add at this point that many of these activities do not automatically become popular. A proper presentation and build-up with enthusiasm and follow-up is quite necessary.

Archery, while an exceptionally fine sport, is not participated in as much as some other activities in civilian life. It has, nevertheless, taken an important place in our program both indoors and out. This is due largely to the interest and enthusiasm displayed by Frank Yetter, a well known archer and expert who has spent many hours giving instruction to beginners. A sound target was developed so that the score could be kept and a hit recognized by the blind archers. Three plates made of metal are hung from a frame. The largest is 42 inches square. The medium-sized plate hangs 3 inches in front of this, and is 26 inches square. The smallest, 10 inches square, is 3 inches away from the medium one and shoulder high. Each gives off a distinctive ring when hit. Direction is aided by use of a metal clapper controlled from the firing line by a string. This strikes the central plate and gives a cue to direction.

The instructor aids beginners in direction and trajectory. Blunt-nosed arrows are used at first with metal tips. Broken arrows were common until a rubber tip was secured to the shaft. This takes up some of the impact and helps keep breakage down to a minimum. It

was found necessary to deaden the sound of the plates. Other blinded men engaged nearby in some other activity are apt to be disconcerted by the sudden and unexpected clang as an arrow hits the target. The range is short enough to enhance the degree of success.

Partial-vision patients enjoy a modified form of *volleyball* which proves to be a good team sport. It necessitates careful planning, however, in order not to embarrass the totally blind patients who can't play. *Horseshoes*, too, has proved to be a good game for men with partial vision. With the shoes and stakes painted white and a white line or cord running between stakes to help direction, enough assistance is given to make a contest.

Weight lifting, although an individual sport, offers plenty of competition for all who can participate, and receives a great deal of attention.

A *rowing* machine receives more than ordinary use; indeed rowing is the most popular sport in the program. Men have actually delayed going on leave and, even more astonishing, have been known to stay aboard an extra day after discharge in order to row against the Army crew from the Valley Forge Hospital. This unusual interest in rowing developed over a period of about 15 months. Garrett Gilmore, one of the former Olympic doubles crew and "Army" Armstrong, a former coxswain, together with the "Schuylkill Navy" and many other Philadelphians helped to create and maintain this interest. Philadelphia has unusually good rowing facilities and has been rowing-minded for many years.

The blind men from the Army Hospital became interested and furnished competition for a number of races. Refreshments were served after each weekly practice or race, and a real spread was offered by a group of ladies headed by Mrs. Garrett Gilmore after the final races. Prizes were donated by interested business men and safety was taken care of by the Fairmount Park police. Team spirit was highly developed and individual sacrifices were made for the group. The men had opportunities to meet others with common deficiencies and interests. They liked the resultant newspaper articles and pictures. In short they found themselves still a part of the world of sport, not blind men to be pitied but members of a winning crew with an engraved oar, belt buckle, or medal to be exhibited, admired and treasured. Men who apparently had no particular interest in anything became enthusiastic after one or two trips on the river.

A few would have nothing to do with the water, however, and refused even to set a foot in the six-oared practice barge. One very popular and likeable colored boy, who had been picked up in the Pacific after having spent several hours in the water, said that he

had promised the good Lord that he would never go on the water again if he got out of that experience alive. Such responses are unusual, however; for the most part the rowing program has aided materially in building and maintaining the morale of the group.

Swimming, one of the best all-round sports, somehow was not enthusiastically received except by a small group. There are several reasons for this. Many of the newly blinded patients undergo extensive surgery, and the only available pool, some distance away from the hospital, serves a large number of men and cannot be scheduled for small, special groups. Moreover almost as soon as men are physically able to enter the water they are ready for discharge or for jobs that fill their time.

Wrestling, often considered an ideal individual activity for the blind, and highly publicized accordingly, is also unpopular. Because of surgery or injuries, only a few men are capable of severe individual competition. Few of those physically able to wrestle have had experience in the sport and others are not interested. Occasionally someone is found who enjoys it but never enough to raise enthusiasm, in spite of the availability of instructors with better than average interest, ability, and reputation.

Light and heavy bag punching had several followers. One Marine in particular, with previous boxing experience, liked to make the light bag rumble. He would participate in no other activity but was excellent with his gloves and worked out daily in the gym. In fact he was finally persuaded only with some difficulty to give up a career as a blind boxer.

Basket shooting is popular as a relaxing sideline. Men who have played basketball shoot goals with a great deal of accuracy and receive considerable satisfaction in being able to outshoot a sighted man in occasional competition.

Golf has many possibilities as an outdoor sport for the newly blinded. Men who have played before their injury do very well. In fact a score in the upper fifties for nine holes is not uncommon. One man, however, who used to play in the seventies, was not content with a "duffer's" score and, at least for the present, has given up all thoughts of playing again. Lining up the drives and putts for blinded golfers is fairly easy, but approach shots, where judgment of distance is vital, have thus far presented a problem. Courses with difficult greens and traps should be avoided, at least during the initial period. Enduring interest and economic conditions at home will probably determine the participation of the blinded in the game. Golf can be played by the blind and is rapidly becoming popular with them.

Rope skipping is excellent for teaching coordination and is good for a work-out. As a foot and leg developer it is unexcelled. *Bowling* has proved itself fairly popular and, with alleys close by for convenience, might easily become the leading indoor activity. Partially-sighted men use the spot system for lining up the direction to the pins. Totally blind men use a rail at a fairly low level to aid direction by following along with the free hand. The approach can be regulated by the usual method of taking a certain number of steps from a pre-determined starting point. For beginners a modified scoring system can be used with only the first ball counting. Later two balls with the regular scoring can be used. The location of any standing pins is given the bowler by a sighted person and spares are picked up frequently. On a public alley the wall on the extreme left may be used instead of a guide rail. Taking only one step will also eliminate the necessity for using a guide. This method is not too satisfactory, however, unless some handy marker will suggest to the bowler his proper position. He feels more independent and confident if he can step up and roll without assistance from another person.

The use of *chest weights* requires no assistance from anyone and, after learning the exercises, the patient can work out by himself. This is particularly helpful with a man who needs remedial exercises for aiding posture or some other special purpose.

A *dart board* provides a recreational game in which the players can keep their own score. An ordinary target is prepared with small grooves outlining the scoring areas, thus enabling the players to determine the exact location of the point zones. Direction and distance are made apparent by the use of a knotted cord secured to the center of the target and held in the player's free hand. A better method, but very complicated and difficult to maintain, is the use of bells which ring when a certain area is hit by a dart. The metal point closes a circuit causing a sound which will vary according to the zone hit. This gives immediate knowledge of success or failure and promotes a normal reaction in terms of interest and enthusiasm.

Fishing, always an interesting and profitable hobby, is easily within reach of the blinded serviceman. Either a rod or hand line may be used, with the caution that the rod requires more than the usual clearance in brush and overhanging trees to avoid a fouled line. Men who were ardent fishermen before the war will naturally go back to it. Others may find that it will take the place of a more active sport such as softball, and fill in the gaps which are bound to be apparent.

Track events such as the standing broad jump, standing high jump, hop-step-and-jump, shot-put and short dashes have been used successfully in programs for the blind for years. Again it has been our

experience that there is a difference as far as servicemen are concerned. Many of the patients are older and don't care for running and jumping. The shot-put has more appeal, in that there is a misconception that it is an event which requires brute strength almost entirely. While strength is necessary, it is coordination which makes a good shot-putter. Many strong fellows have found that the sport requires more practice than they wish to give to it, and therefore have failed to become proficient. Surgery keeps many men from participating in these events and many of those who might participate in track or field are surveyed at about the time they might make a start. With adequate facilities, however, much can be accomplished in these sports.

SUMMARY AND CONCLUSIONS

There has been presented a discussion of the principles and procedures incorporated in outside orientation and physical reconditioning, the twofold contribution of the Department of Physical Education to the rehabilitation of the newly blinded at the U. S. Naval Hospital, Philadelphia. This discussion is based on our experiences with 157 such patients. Depending upon the presence of such intangibles as the desire to adjust, intelligence, sensitiveness, and alertness, patients learn successful adaptation to their environment out of doors. Among these factors, those of general intelligence and the ability to develop sensory responses, particularly hearing and smell, are especially important.

In terms of physical conditioning, it is believed that some considerable contribution has been made to the welfare of the blinded patients. Keener interest and a healthy desire to participate in sports is evident after a few class sessions. With the return of physical self-confidence and the knowledge that there is a place for them in the world of sport comes a new lease on life. Moreover aside from the maintenance of normal bodily functions and general physical condition, the social adjustment through group participation in sports and games has been found to play an important part in the blinded patient's adjustment.

VII. EDUCATIONAL AND VOCATIONAL COUNSELING

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Counseling procedure for the war blinded, like all sound counseling, is based upon several principles, perhaps the most fundamental being that a wide range of abilities and capacities exists within any person. Adequate diagnosis of capacities and training of skills should develop some useful attributes in any patient. Scarcely less important is the principle that the development of a socially useful skill is a paramount factor in the individual's psychologic rehabilitation, and its corollary, that improving psychologic adjustment facilitates the development of desirable skills.

Another basic principle holds that in the guidance process the counselor changes as well as the counselee. The counselor must be cognizant of these changes. Counseling is more than advising; it is a process of interaction in which both parties change. Meaningful vocational guidance is a continuous process and does not take place in any one conference or reach conclusions at any one moment. It utilizes all personal history available on the individual, takes into account the special opportunities and limitations of the area to which the person will return, and makes available to him a variety of vocational advisement resources, and a program of practical work experience.

The program for educational and vocational counseling of the blinded in this hospital, and our experiences with 157 such patients are reported here. This counseling begins officially in an initial interview, conducted jointly by the educational services officer assigned to this duty, the pharmacist's mate, first-class, (teacher-attendant) who acts as a supervisor of the patients' work experiences outside the hospital, and the occupational therapy officer who conducts the within hospital prevocational training program for the blinded. The patient's educational background, his interests and hobbies, his preservice work experiences (both casual and formal), and his in-service training and duty are thoroughly explored. Pertinent data are obtained from service records and qualification cards, and from the man himself. The man is encouraged to discuss his ambitions and aims as they existed prior to his blindness, and any changes of thinking introduced by his disability.

On the basis of this interview, a series of recommendations as to a work program are discussed with the patient himself and forwarded to the supervisor of re-education. These include specific tasks to be tried in the occupational therapy shop, field trips, interviews outside the hospital and short work try-outs in shops at the Philadelphia Naval Base and the Marine Corps Quartermaster Depot. The patient learns that although the hospital is not equipped to provide complete vocational training, he will be able to get an orientation to an area of work in which he may later obtain training through veterans' facilities. Follow-up interviews are held to discuss with the patient the progress of his reorientation, and to evaluate the results of his work experiences. Frequently these follow-up interviews are quite informal.

Planning

After the patient's return from the New York Institute for the Education of the Blind, further planning is done, in light of the psychologic test results and job try-outs conducted during the 2 weeks' period of observation which each of our patients undergoes in that institution. If it appears that a man's best opportunities lie in industrial training and placement, a half-day job in a suitable Philadelphia industry is obtained. This training is begun only after the patient produces evidence of satisfactory achievement in his classes, and in his inside and outside orientation courses. He is expected to complete at least 4 weeks of steady employment before his discharge from the hospital.

If further academic schooling is in order, proper accreditation is instituted, tutoring is arranged, and high school completion or preparation for college is facilitated. If the patient is interested in retail business, he obtains valuable information through interviews with local business men, both sighted and blind, and from trips to business establishments. He may receive preparatory training in office practice at a local business school. He will have a period of employment in the Ship's Service stand for the blinded at this hospital.

At a terminal interview with the educational service officer, each man receives final information concerning the specific guidance agencies he is to approach in his home area that he may continue his training or education. In addition he receives information from the veterans' employment representative of the United States Employment Service relative to procedures for obtaining a suitable job in his home area.

These are, in brief, the individual guidance procedures. In addition, the educational services officer conducts weekly group guidance classes in which vocational opportunities, the abilities and training

needed for them, and the particular advantages and hazards involved, are considered. These meetings also treat the psychologic adjustments of the blinded ex-serviceman generally and constitute, so far as is known, a unique venture in group guidance and psychotherapy with the newly blinded.

Prevocational training experiences

The varied nature of prevocational opportunities within and outside of the hospital will be of interest. Activities carried on within the hospital are described in the report of the occupational therapy officer assigned to the blinded. Among the contacts established outside the hospital in the Philadelphia area are the following: Three machine shops, the Air Materiel Center at the Naval Base, a candy manufacturing firm, a wood and plastics fabricating firm, a metal fabricator, a hobby shop, a business school, an agricultural school, a metal plating factory, a commercial photographer's studio, a roll-film developing establishment, a window-decorating and advertising service, a lumber yard, and a number of professional and business men who have contributed information and advice to patients personally.

Since the vocational guidance and prevocational training service was inaugurated in March of 1945 to complement the earlier existing educational guidance program, 30 men have been placed with 6 different firms, of whom 27 stayed for at least 4 weeks of steady employment. Six men were placed at the Palmer Business School, which has offered a tuition-free training arrangement in conjunction with the State Board of Rehabilitation. Four of these men worked sufficiently long to supplement appreciably their typing instruction received at the Naval Hospital, to take a course in business letter forms, and to complete an introduction to dictaphone operation.

Seven men spent week ends as guests of the Ambler School of Horticulture, Ambler, Pa., participating in farm chores, and discussing their particular farming interests with the head teacher. This has proved a valuable experience for blinded men with previous farm experience, in showing that they are still capable of successful, independent activity. It is hoped that an earlier-proposed 2-week training program will eventually be approved.

Eighteen men spent at least one full working day at the Naval aircraft factory, Naval Air Materiel Center, Naval Base, Philadelphia. All these men profited from the trip; that is, they learned certain power machine operations, turned out a few production items, and discovered that they were capable of industrial work. Three men, however, definitely ruled out industrial work of this type, for various

personal reasons. All the men benefited particularly from the personal instruction of a skilled, blinded machine operator who is a civilian worker in the plant.

Actual job operations successfully mastered by blinded and partially sighted patients have included the following: Sub-assembly of parts, using power presses, staplers, etc., sub-assembly of parts by hand; packing, crating, nailing; hand tapping, boring and reaming; drill-press operation on both wood and metal jobs, including job set-up; steel wire cutting and forming; inspecting and cleaning of parts; arbor press operations; hand work on leather and wood novelties; hand work on athletic equipment; stockroom work; order filling; window displays; all types of farm chores with the exception of heavy field work; and photographic darkroom work, with the exception of retouching and printing.

Placements on the job are made, in each case, after careful selection and counseling. Men are advised to try out only if previous skills and demonstrated aptitudes indicate some probability of successful learning and adaptation. The patient to be placed is accompanied to a previously surveyed job by the pharmacist's mate in charge of job placement and supervision, who introduces the patient to the factory owner or manager, to the foreman, and to the job itself. Frequent follow-up visits supply progress data. The excellence of this work is attested by the high proportion of successes and by the very few instances in which men have had to be shifted from jobs within a plant. In only one instance was a patient removed from a job at the request of the employer.

This policy of careful placement and follow-up is approved practice in modern work with the blind. It insures a high percentage of success, which pays off in improved patient morale. It also insures that such rebuffs and failures as occur in a training period will be interpreted adequately by the patient with the assistance of a counselor who also knows the situation.

It may appear that undue emphasis has been placed upon jobs in open industry. However, it has seemed important that blinded men discover early that they can carry on successfully alongside sighted workers. It has also seemed important to use the war-created labor shortage as an opportunity to educate employers to the feasibility of employing blinded workers.

In addition to the specific job and school placements mentioned, more than 40 field trips have been made to introduce a patient to a professional or businessman or to an industrial process. These trips were made with no intention of placement but to give the patient experience in facing "public" situations and occupational information and advice.

In these trips, and in getting men to jobs, the Red Cross has been most helpful in providing transportation. It is recognized that blinded men will have to travel unassisted in civilian life, but the demands of the hospital schedule require that men be transferred as quickly as possible. Consequently it has been feasible in only a few cases to have men travel by public conveyance and unattended.

The program of counseling and prevocational training here outlined stops, as far as this hospital is officially concerned, at the time of the man's discharge from the hospital and from the service. Actually, rehabilitation, like all learning, cannot be confined to any one segment of a serviceman's life. The phases of adjustment which go on after a patient leaves the program are no less important than those which occur within the hospital. Effective liaison with the civilian agencies which take over the job does much to insure continuity, and, in the last analysis, rehabilitation is accomplished only within the man himself. Agencies and programs can only facilitate the process.

The operation of our program can best be shown by some illustrative case reports.

CASE REPORTS

Case 1.—A storekeeper, third class, has just enough useful vision to aid him in traveling in daylight; for all industrial or business purposes he is blind. The success of counseling in his case can undoubtedly be traced to his own motivation to make good. Before the war he married a retail lumberman's daughter and he wants desperately to succeed on his own merits. He had started at the bottom and was "on the way up" when he entered the Navy.

In discussing the possibilities at the Naval Hospital, he requested a chance to learn x-ray film developing. He saw several applications of such skills in his home city. There is a Veterans' hospital in the vicinity, a large civilian hospital, and there is the possibility of establishing a commercial photo finishing business. He is keeping in the background of his thinking the probability that eventually he will return to his father-in-law's business. It is most important, however, that he prove himself in his own venture first.

After completing his course of training in the dental x-ray laboratory in this hospital, he was taken to a commercial photofinisher's establishment, where he examined the equipment and discussed phases of the business with the owner-manager. He was also accompanied to a large lumber yard to "talk shop" with the manager. Several attempts were made to obtain a part-time job in a photographic establishment, but wartime film shortages made such a placement impossible.

On his own, this man turned to a large hospital in Philadelphia, where he obtained a job as darkroom man in the x-ray department. To this patient's credit, it must be added that an earlier official contact at that hospital had not convinced those in charge that such a plan was feasible. At present he is working full time at that hospital and will continue to do so for some time after his discharge.

Case 2.—A Marine private, first class, hit on Iwo Jima, has suffered the loss of both eyes. Of very superior ability, he had been prevented from completing

his schooling, although he did achieve his high school diploma through evening classes. He worked his way up from train vendor to counterman in charge of the commissary for a divisional office of a large railroad.

Possibly his greatest asset is his wife, who has a remarkable facility for making him feel the desirability of resuming employment and continuing his role as husband, father, and head of the house.

Three plans have been developed with this patient. The first is to return to the employ of the railroad company, though of necessity in a different capacity than formerly. He has received considerable training in typing and dictaphone operation which may fit him for any one of several kinds of office positions. As a second outlet, he requested and was given x-ray film developing. This skill alone or in conjunction with the ability to type from a dictating machine could fit him for employment in a hospital, either with the railroad or in a public institution. The railroad in question has been contacted concerning these two possibilities and the personnel office is working on the matter at the present time.

A third possibility, held as a reserve by the Marine, is poultry raising, in which his wife has had some experience. The educational services office supplied material on poultry raising which has been read to and discussed with the patient. A trip to the Ambler School of Horticulture supplied him with a practical, though brief, exposure to some of the technicalities involved. Further training would be desirable if this alternative is finally elected.

Because of his general ability, the man has been encouraged to continue his academic education if his circumstances permit. Blinded men have an opportunity to live in the world of ideas, but not all have the equipment, as this man, to live creatively in that world.

Case 3.—A Marine private, first class, also totally blinded at Iwo Jima, intended from the very first to return to his family's cattle ranch in the West. He is younger than the other two men cited and had not completed his high school work. His chief concern at the hospital was to adapt himself personally to his blindness, and, if possible, to complete his high school course.

Through the courtesy of the Red Cross, a tutor was obtained who worked intensively with the patient in three required subjects: American history, grammar, and civics. U. S. Armed Forces Institute examinations were administered orally. Credits in these courses plus credit for his typing instruction and physical training were sufficient to obtain his diploma.

Case 4.—A Marine private, first class, retains enough vision to aid in his daytime travel. He entered the hospital with a desire to enter work for the blinded, though he had not the faintest notion of the amount of training that would be necessary.

A number of conferences with the educational services officer and with other rehabilitation workers convinced him that a college education would be desirable to start his training. To further his background for rehabilitation with the blinded, he was given a series of assigned visits to agencies for the blinded in the Philadelphia area.

He was also encouraged to gain as much experience with tools as possible. Placement in a machine shop afforded him experience in a wide variety of hand-tool operations and with several types of power tools.

At the time of his discharge, an organization for the blinded in his home State put him in charge of a soda fountain and variety store. With his wife's help he ran this venture most successfully. At the present time he is completing arrangements to enter college.

SUMMARY

At the U. S. Naval Hospital, Philadelphia, educational and vocational guidance is carried on cooperatively by the educational service and occupational therapy officers assigned to activities with the blinded. Vocational counseling utilizes psychometric reports prepared at the New York Institute for the Education of the Blind, and projects prevocational job experiences in the Philadelphia area for as many men as possible. These experiences include a considerable variety of schools and manufacturing and business institutions. A program of supervision and evaluation insures that the patients receive the maximum benefit from their job try-outs, field trips, and interviews. A few examples, drawn from the 157 blinded patients in the program, illustrate the procedures and demonstrate the practicality of the program.

E. NEUROPSYCHIATRIC REHABILITATION

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The statistics in table 1 show the distribution and disposition by survey of 1,759 neuropsychiatric cases in this hospital for a 9-month period from 1 January to 30 September 1945. During this period there have been some changes in diagnostic nomenclature and in the attitude toward outcome and disposition. "War neurosis" was used at first as a diagnosis on all patients whose mental state was a direct result of battle or operational stress, and they were discharged under this diagnosis whether they had recovered entirely or were only improved. "Combat fatigue" replaced the diagnosis of "war neurosis," and when these patients had recovered, they were discharged home under the diagnosis "no disease." The diagnosis "personality disorder" replaced the diagnosis "inadequate personality," "emotional instability" and some of the long-standing mixed psychoneuroses, as well as those showing a mixture of psychopathic and neurotic features. But though the labels changed, the problems remained the same.

It gradually became apparent that the emotional battle casualties arriving at this distant point from hostilities stood little chance of being returned to combat. A number of factors entered into this:

1. The time factor had allowed attitudes toward combat to become fixed. In many there was also a fixation of symptoms. These symptoms were apparently presented as a displacement or unconscious explanation of their inability to fight again. Long hospitalization periods while awaiting transportation had given them unhealthy attitudes and helped fix the feeling that they were sick.

2. They were long separated from their units and the supporting group of their comrades; they felt they had been failures, had forfeited the respect of members of their unit and the military in gen-

eral, and did not wish to face their comrades or battle tests again. There was also sometimes considerable concern about the opinion of civilians regarding their past performance and fear of their ability to perform well in civilian life. However the stronger family and early environmental ties, and feeling that they had previously attained a measure of success in civilian life, drew them strongly homeward.

TABLE 1.—*Neuropsychiatric department surveys 1 January to 30 September 1945*

Diagnosis	Transferred to Bethesda	Discharged to home	Discharged to duty	Permanent shore duty	Limited shore duty
Alcoholism, chronic		8			
Arteriosclerosis, general		1			
Blast concussion, atmospheric (head)		1			
Cerebrospinal meningitis					1
Constitutional psychopathic inferiority		15			
Constitutional psychopathic inferiority, without psychosis		29			
Constitutional psychopathic state, emotional instability		124			
Constitutional psychopathic state, inadequate personality		65			
Constitutional psychopathic state, schizoid personality		39			
Deformity, congenital, arm, left foot		1			
Degenerative disease of the brain	1				
Dementia praecox	24	9			
Diabetes mellitus		1			
Diverticulum (lesser curvature of stomach)		1			
Enuresis		2			
Epilepsy		23			
Fatigue, combat					97
Fatigue, operational			4		51
Headache		3			
Hemorrhage, cerebral		1			
Hemorrhage, subarachnoid		1			
Hypochondriasis		1			
Intracranial injury		9		2	2
Melancholia, involuntal	1				
Meningomyelodisculitis			1		
Mental deficiency		28			
Migraine		6			
Motion sickness				45	
Myasthenia gravis		1			
Narcolepsy		1			
Neuralgia, trigeminal (ophthalmic division)		1			
Neuritis, sciatic nerve		2			
No disease		433	17		1
Paralysis, left brachial plexus		1			
Personality disorder		331			
Poliomyelitis, anterior acute		1			
Prostatitis, chronic		1			
Psychoneurosis, anxiety neurosis		77			
Psychoneurosis, hysteria		3			
Psychoneurosis, mixed		17		1	1
Psychoneurosis, neurasthenia		5			
Psychoneurosis, situational		9			
Psychoneurosis, traumatic		4			
Psychoneurosis, war neurosis		219		1	
Psychosis, manic depressive	7	1			
Psychosis, traumatic	1				
Psychosis, unclassified	6	1			
Psychosis with organic brain disease	3				
Psychosis with psychopathic inferiority	1				
Reactive depression	4	4			
Sclerosis, disseminated		2			
Syncope		3			
Syringomyelia		1			
Tremor, familial			1		
Totals	48	1,486	23	49	153

(Total surveys: 1,759)

Statistics of the diagnoses of those patients discharged to duty without survey are not available. These constituted a very small number, a few recovered from mild combat fatigue, some who were sent in for neuropsychiatric study and some recovered from neurologic conditions.

3. The general attitude of some medical officers was that any man once a neuropsychiatric casualty was unsuited for further combat. Even if returned to their units, they would frequently be sent back on the sick list with very slight symptoms. Adequate evaluation of treatment methods and later combat performances of those once showing combat fatigue symptoms have never been reported, to our knowledge, and this lack is responsible for this attitude.

4. Motivation was often poor, also due to the general belief that a neuropsychiatric casualty could not hold up again. There was in addition a strong feeling that one period abroad constituted their duty, and that there were enough others who had not seen battle who should take their turn.

With these factors working against them, and the manpower shortage not acute, the logical procedure seemed to be to cure these men of their symptoms and return them home, sending back to duty only those with very mild cases and the very few who simulated illness. The patients who suffered from long-standing psychoneuroses and personality disorders which had become more acute by virtue of service stresses, were obviously vulnerable material for future breakdowns and should be returned home. Many of these showed symptoms as a result of faulty adaptation to noncombat service conditions; others showed superimposed combat fatigue symptoms. In such cases, due to their long-standing basic difficulties, usually the most that could be expected of treatment was to restore them to their basic pre-enlistment personalities before discharge.

The following outline covers in general the rehabilitation program in the divisions of the neuropsychiatric service of this hospital. It is divided into treatment of enlisted men and officers at the main hospital and that at the Convalescent Annex at Swarthmore.

Treatment of enlisted personnel at the main hospital

The staff was organized to complete the physical, neurologic, psychiatric, and laboratory studies of all new patients within the first few days after admission. All patients were placed on a treatment program which was arranged to provide for psychotherapy, competitive athletics, occupational therapy, physiotherapy, and hydrotherapy. Participation in the program was expected of every man. Morning sick call was conducted in such a manner as to follow the progress of each man and to create good ward morale through professional interest and understanding.

Patients were generally given a great deal of personal attention from the medical officers, nurses, and corpsmen and made to feel that their performances had been good; thus a generally optimistic atti-

tude toward their recovery was instilled. Every effort was made to have the patient feel his problem was thoroughly explored and capably and efficiently handled. The ward morale was kept high, and this was considered a valuable therapeutic aid.

In general, the individual psychiatric interview was considered the mainstay of treatment, with group psychotherapy, narcosynthesis, work, and recreational and educational programs, and the maintenance of high ward morale as contributing factors. The patient's service problems had first to be resolved as completely as possible; then therapy was directed toward his readjustment to civilian life.

Within a week of admission to the hospital each patient was called into staff conference where his symptoms and his treatment were discussed and explained. This was done in simple nontechnical terms. In so far as it was possible, each patient was also told at this time the medical disposition that would be recommended in his case. Limited duty was the therapeutic goal for the mild anxiety states; discharge from the service, after completion of treatment, was the goal for the severe anxiety reactions.

Special treatment technics were used in selected cases. Fourteen percent of patients received narcosynthesis. This technic was reserved for those patients who were blocked in expressing their conflicts, or who were so restless, tense, and agitated that they were unable to discuss their battle experiences. The number of treatments varied from one to eight; the average was two. Twenty-two percent of patients (selected because of apparently stable precombat personalities) were transferred to a special combat fatigue program at the Swarthmore Convalescent Annex where there were special facilities for group psychotherapy, athletics, and recreation.

Twenty percent of patients were assigned to a program of work rehabilitation which consisted of holding a job in civilian industry as part of their hospital treatment. This program of rehabilitating combat fatigue patients through work was started in April 1945 and was reserved for those who were to be discharged from the service on the completion of their treatment. Through the efforts of the educational officer and War Manpower Commission, servicemen were placed in civilian industry and continued at the same time on a patient status at the hospital. These men were granted liberty to go to work, but were required to return to the hospital each night. Every Saturday they were interviewed by their ward medical officer as to their work progress and interpersonal relations. The men assigned to this program responded with enthusiasm. During the first week it was frequent for them to have an increase of their anxiety, following which these symptoms subsided.

This program had several psychologic advantages: The work was real, the men were paid for their work, it returned them to an environment with which they were familiar, and it reassured them in their ability to hold a job upon discharge from the service. There were no complaints about work performance. Many of the men assigned to this program remained after their discharge as permanent employees. The men welcomed work as a healthy release from hospitalization. They worked with enthusiasm, were amenable to orders and proved themselves capable of heavy work. They found great support in the friendly and relaxed attitude of their fellow workers. The result of all of this was to rebuild their morale and to restore their confidence and self-esteem to a point where they felt a renewed confidence in their ability to hold a job and resume their civilian responsibility.

Treatment of officers at the main hospital

During a 10-month period from November 1944 to September 1945, 145 officer patients admitted to sick officers' quarters were transferred to the neuropsychiatric service for treatment and disposition. This group comprised 131 commissioned officers and 14 warrant officers.

These patients fell into three principal diagnostic categories: First, those who exhibited manifestations of accepted psychiatric disorders; second, those whose condition did not warrant a psychiatric diagnosis, but who had become noneffective due to an incapacity to adapt to present or future demands of the service; and last, those who suffered from organic neurologic disturbances.

The first, or purely psychiatric category, was the largest, consisting of 98 patients or 67 percent of the total. Among these, fatigue syndromes were the most common disability, being present in 35 patients. Instances of operational fatigue (23 cases) almost doubled those of combat fatigue (12 cases). Contrary to findings among enlisted personnel, and probably due to factors of more careful selection, cases of pure combat fatigue, with intense and catastrophic abreaks, were rarely observed. Inability to cope with mounting responsibilities, loss of stamina in the face of prolonged and arduous duties, difficult interpersonal relationships aboard ship, and distressing situational factors at home appeared to be the most salient psychic factors leading to anxiety and exhaustion of emotional reserves.

Next in importance in the psychiatric category were personality disorders, with predominant emotional instability. In the main these were conscientious but immature persons giving a lifelong history of tendencies to over-react to stimuli and to manifest emotional incontinence and autonomic imbalance when exposed to situations of stress and strain. Among other personality disturbances there were

five cases, or 3.4 percent of the total, of schizoid reaction types. There were two cases of pathologic sexuality without associated mental disorder. No cases of constitutional psychopathic inferiority were found.

Fourteen patients, or 10 percent of the total, showed evidence of a chronic psychoneurosis. Although their symptoms were frequently mixed in type, the predominant conscious reaction was invariably one of anxiety. The majority of these patients showed neurotic patterns of behavior which were manifest upon entry into the service, or were present in their early life, later overcome, and then temporarily re-activated after exposure to trying conditions.

Seven patients (4.5 percent) were actively psychotic. Of these the condition of four appeared to have been precipitated by increasing tensions built up by virtue of being in the service.

Finally, there were 21 cases (14.5 percent) of minor transient psychiatric complaints, such as headache, insomnia, acute alcoholic episodes, etc., which arose as an expression of temporary tensions, and were not considered to be fundamental disorders. They quickly subsided under a routine of rest with psychologic clarification. All these patients were returned to full duty.

In the category considered as failures in adaptability were included those who were temperamentally unsuited for any type of duty (2 men) and those who had successfully achieved various degrees of service, but who were unable to continue beyond a certain point (25 men). Efforts to induce them to proceed beyond their natural limits of adaptability brought forth anxiety, whereas their failure to extend themselves resulted in feelings of guilt and depression, thus establishing a vicious circle. Characteristic of this group were men of advanced years with fixed behavior patterns and overconscientious, perfectionistic, and inflexible personalities who adjusted poorly to rapidly changing situations and to increasing responsibilities.

There were 20 organic neurologic disorders or 14 percent of the total. Of this number, 9 were intracranial injuries, of which 4 resulted from exposure to atmospheric blast. Infectious diseases came next in number and included 4 cases of Bell's palsy, 1 Guillain-Barré syndrome, and 1 case of brachial plexitis. In addition, there were 2 cases of cerebral vasospasm, 1 case of syringomyelia, 1 case of ophthalmoplegic migraine, and 1 fatal case of a fulminating encephalopathy in a chronic alcoholic.

Therapy was directed toward a return to some form of active duty. If this goal could not be attained, efforts were made to equip the patient for a satisfactory adjustment to civilian life, or at least to restore him to his preservice level of psychic functioning.

Fatigue syndromes were treated with a program of rest, narcosynthesis, occupational therapy, and psychiatric interviews. The patients

were allowed to subsist out, but some sort of occupation was mutually agreed upon. They reported to the hospital about 3 days a week for appraisal and further therapy. After several initial ventilations of anxiety and irritability by narcosynthesis, psychotherapeutic interviews were undertaken which were directive and interpretative in character. The therapeutic goal in these instances was a return to some form of duty.

A somewhat similar routine was offered to those who could not adapt to further demands of the service. Psychotherapy was directed especially toward alleviation of feelings of guilt and depression. The therapeutic goal was readjustment to a civilian occupation.

For the chronic psychoneurotic states a modified rapid analytic therapy with the establishment of a dynamic therapeutic relationship without any extensive excursions into the patient's past life was frequently tried with some success. The therapeutic goal depended on the reversibility of the condition. Neurologic disorders were treated with established therapeutic practices.

Using these procedures, 75 patients (53 percent) were returned to some form of active duty; 42 to full and 33 to limited shore duty. Of the 35 patients having fatigue syndromes, all were returned to duty: 17 to full duty and 18 to limited shore duty. Of the 14 patients with chronic psychoneurosis, 4 were recommended for limited duty and none was returned to full duty. In this group only 3 were recommended for retirement, all of whom were men in the older age brackets with a history of prolonged and rugged duty which had apparently resulted in fixed irreversible psychoneurotic patterns which rendered their chances for a satisfactory civilian adjustment extremely dubious. All 7 psychotic patients were transferred to the U. S. Naval Hospital, Bethesda, Md. Of the 20 neurologic cases, 4 men were returned to full duty, 7 to limited duty, 5 were discharged, 2 were retired, 1 expired, and 1 is still under treatment.

*Treatment of combat and operational fatigue at Swarthmore
Convalescent Annex*

The Swarthmore Annex is a branch of the U. S. Naval Hospital, Philadelphia. It is a part of the rehabilitation program and has had an average neuropsychiatric census of about 75 patients. Two psychiatrists were attached for their care.

The psychiatric patients were selected by the neuropsychiatric staff of the main hospital. The patients usually had combat and operational neuroses which could benefit by this treatment program. Patients who turned out to be unsuitable were returned to the main hospital. The patients averaged 25.8 years of age, had had active duty

usually since the very beginning of the war, and averaged 22 months overseas. The average patient did not break down until his second tour of duty overseas and, even so, was overseas for 14 months before admission to the sick list. He felt his symptoms on an average of 7.5 months before turning in on the sick list.

The treatment program was relatively intensive, with two psychiatrists serving the patients who remained for 1 or 2 months. As the program was evolved, it aimed to meet the patients' individual problems, to increase their general insight, to reintegrate them into group life, and, by graded activities and responsibilities, to bring them back to independence, whether for full duty, limited duty, or civilian life.

During the war approximately 55 percent of those treated at the Annex were returned to limited duty, 5 percent to full duty, and 40 percent were discharged. Of course such dispositional figures are of limited significance as concerns therapeutic efficacy. In large part they reflect the kinds of cases selected; they tell nothing of those severely disturbed men who improved tremendously but still required discharge. Now that the war is over, the therapeutic task is rehabilitation for an independent civilian life. The character of the cases is already changing. Reactions to combat and other stresses still continue, but problems of civilian adjustment, such as marital and occupational problems, and also more typical peacetime neuroses are becoming more prominent, and no doubt the temptations of pensions will loom ever larger.

Upon admission here, each patient was interviewed by the chief pharmacist who explained the program and the organization, and sent him with a routing slip to each activity. Then followed the interview with the psychiatrist, designed to penetrate to the man's particular problem and to the causes of his symptoms. This interview, of about an hour, with very little further follow-up, achieved marked results in about a third of the cases, and good results in another third.

Through this therapeutic interview the psychiatrist got to know each man and his fundamental problem and was able to form relatively homogeneous groups for group therapy. These classes were both educational and therapeutic. They covered what the patients should know of the emotional causation of their symptoms.

The over-all organization of the entire group of patients provided facilities, both personal and impersonal, for all gradations from rest and withdrawal, to activity, social contacts, and responsibilities. Some physically and emotionally exhausted patients at first required rest, with gradually increasing activity; others were very tense and did better on gradually decreasing activity as they learned to relax.

For the average patient, the setup provided a regimen of gradually increasing activity, which afforded ample rest and recreation without permitting too much regression, and which led the men to increasing independence, responsibility, and social contacts.

The men have endured emotional, physical, and sometimes intellectual strains, and the regimen was directed toward relieving the effects of these, particularly, of course, the emotional. There was a well-organized physical training program, lectures on world events, and all manner of correspondence courses, as well as photography, radio, wood, plastic, and metal workshops, and a victory garden. Through the Red Cross, coffee hours and parties were provided which gave men suffering from combat fatigue an opportunity to increase their tolerance for people and to ease themselves back into personal relationships.

The occupational therapy shops were not set up on the basis of play, nor to produce attractive objects, but as vocational pursuits to counteract the man's tendencies to helplessness, increase his interest and effectiveness in reality, and develop these to the point of enjoying work and independence.

As the men became capable of group living, smoother interpersonal relationships and increased activity, more responsibility was given them in the work program. Photography has been run almost entirely by the patients. The hospital program, with all the work of maintaining and operating the establishment, offers a natural and smooth transition to the requirements of civil life.

Thus the psychiatrist used all available psychiatric therapies—the interview, the group session, occupational therapy, educational and recreational activities, as well as all accessory methods, physiotherapy, insulin to increase appetite, and so on. Hypnosis was occasionally useful and sodium pentothal, of proved value, was used as indicated in expediting the individual interview. Special moving pictures on combat fatigue, and records made by us for the same purpose, aided in group sessions and in training the staff. A method of using films of battle scenes proved valuable for desensitization of startle reaction. Various technics and methods were tested as they came to our attention.

The staff was instructed in the nature of the patients' emotional problems and so was equipped to help with their attitudes as well as with the many facilities of the program, to see the men through from sometimes extreme passivity, withdrawal, helplessness and dependence to emotional functioning as adult citizens. At first the men required above all understanding and also sympathy, support and even indulgence. This did not mean coddling. They had been going

downhill after their intolerable experiences. This treatment proved the support necessary to reverse the process and to give them the courage and increasing will to return to independent, productive, social existence.

SUMMARY

In a 9-month period between 1 January and 30 September 1945, 1,762 patients were surveyed from the neuropsychiatric service of the U. S. Naval Hospital, Philadelphia. Of these, 368 (21 percent) were diagnosed as having combat-induced conditions; namely, fatigue, combat; fatigue, operational; and psychoneurosis of war. Of these in turn, 149 (40 percent) were surveyed to permanent or limited shore duty, and the remainder were discharged home on completion of treatment. Only a very small undetermined percentage was returned to full duty without surveys.

F. THE RED CROSS IN REHABILITATION

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The American Red Cross, in accordance with its Charter, Navy regulations, and written agreements with the Chief of the Bureau of Medicine and Surgery, provides all Navy hospitals with a program of social service. The hospital work of the Red Cross is, and has been, a medically directed and medically oriented program. Red Cross is part of the hospital staff and operates as such. One of its contributions, however, lies in its position as the liaison organization between the military and community groups. As a nonmilitary group, it is in the unique position of being an accredited civilian organization able to enrich its program on and off the station by the utilization of skills and resources of outlying community groups.

The importance of this faculty is readily seen in the consideration of Red Cross function in a rehabilitation program. Because a rehabilitee is returning to civilian life, almost immediately his major concern is with his adjustment, social and personal, to that civilian life in the light of his disability. Up to the point where he becomes absorbed in a rehabilitation program, his only life with his disability has been purely a military one, and he may well have question as to his acceptance by a community not so adjusted to disability. His first meeting with the Red Cross staff, and community groups with whom he is brought in contact by that staff, may be for him a testing point.

It is not always possible to delineate the exact point at which assistance in the rehabilitative process may begin. As will be seen, initial steps are often taken while the patient is still undergoing major surgery and medical treatment, in order that he may more

quickly be helped to a point where he is receptive of rehabilitative education. At the same time, help is given by the utilization of ward recreation service.

The function assumed by the recreational and case work staff of the Red Cross in the hospital reaches far outside, as the patient may be brought into touch with sources of aid in his home community which will continue to offer him assistance, should he desire it. At his request, or at least with his knowledge and consent, correspondence is carried on with the Red Cross chapter in his home community informing them of his impending discharge, and again with his consent, interpretative assistance may be given to his family or prospective school or employer. The dual role of the Red Cross of giving help to the patient and giving interpretation to the community of the needs and feelings of the disabled veteran is brought into sharp focus in such a case.

One basic working rule of this organization must be emphasized. That is, that Red Cross offers assistance in any social area in which it may be of service, but these services are not forced upon the patient. The recreational facilities and case work services are available upon request, but the patient is free to reject them if he so desires. The only exception is the request of the medical officer for a social history of the patient when it is deemed necessary to his treatment.

CASE WORK

The services of the American Red Cross have been available within the U. S. Naval Hospital, Philadelphia, since it first began operation in 1935. The beginning unit of three people, a field director, recreation worker, and a case worker, has been enlarged since the onset of the war. In addition to the greatly increased number of service patients, the hospital has continued to give care to the veteran patients. Today, the social service department of the Red Cross in this hospital has a total of 16 case workers, 12 recreation workers, and a trained corps of volunteer Gray Ladies. Four case workers have been assigned to the three rehabilitative services.

The efforts of the Red Cross social service department, like those of every other service of the Naval Hospital, are geared to help the patient in his recovery. Because patients react differently to illness and injury, their ability to use the facilities set up for training will vary with individual patients. Problems of personal attitude or anxiety arising from trouble at home may prevent a man from deriving the full benefit of any rehabilitation program. The social worker is concerned with so helping the patient that he may achieve a satisfactory use of his capacities within the limitations of his disability.

Making the transition from military to civilian life with a physical disability is recognized as no small task for the strongest personality. Prior to their entrance into service, these men were successful within a normal range in a competitive world. They must again meet the demands of this civilian world when they leave the hospital. The patient who squarely faces the fact of his disability and can adapt himself to new ways goes out with confidence and courage. He may even have special pride in a newly acquired skill, for his positive attitude has enabled him to apply himself diligently to rehabilitation training.

The patient whose tendency is toward a loss of self-confidence usually requires considerable help in adjusting himself to change. If his fear is too great, he puts forth no real effort toward independent management, for he avoids facing a possible personal failure. The worker's efforts must be an attempt to help him build self-confidence, change his attitude, and redirect his energies toward achievement which will bring him satisfaction and independence.

Through the knowledge of human behavior, with which her professional training should equip her, and practiced skill in working with people, the social case worker is in a position to be of help to the patient through this difficult period of readjustment. She acts only under medical authority and usually upon direct request from the physician. During a period of continued contact with a patient, she seeks periodic consultation with his physician in order that her efforts may be in keeping with the patient's medical progress.

Sometimes the impediments to a patient's progress in rehabilitation lie not in his attitude but in difficulty at home. Practical needs of family members may require referral to Red Cross chapters and the utilization of resources in their community. Arranging for such needed assistance serves to relieve suffering at home and to free the patient's mind to apply his full attention to the rehabilitation training made available to him. Sometimes difficulty at home has direct bearing on the patient's disability and his later return to the home. If this is the problem, the case worker corresponds with the Red Cross chapter near the family. Interpretation to the chapter of the patient's condition and potentialities, presented in a form suitable to the patient and approved by the physician, enables a case worker from the chapter to help prepare the family for the patient's homecoming.

The following cases are illustrative of the problems which come most frequently to the case worker. They are typical of the kind of situations which arise, although there are often more complications and ramifications than here presented. The details of case work

treatment must naturally vary with each patient, his particular situation, and his response to the worker's endeavor to help him.

CASE REPORTS

Case 1.—A 19-year-old seaman had enlisted in the Navy while a college student. He was wounded during the landing at Guadalcanal and again aboard ship. He had spent 2½ years in the hospital and appeared to be making a good adjustment to the amputation of his right leg. Despite a misleading outward cheerfulness, he was actually withdrawn and took little part in general social activity.

Precipitated by a change in staff which brought him a physician who was new to him, his hidden fears about himself were brought to the surface. He expressed to the social worker his discouragement at the slowness of his recovery and at this point seemed forced to relive the details of his injuries and his personal reactions following the experience. Only after he had been able to satisfy this urgent need, was he able to think clearly and see himself in relationship to other men. He had not realized that other disabled men felt and feared the same things he did. He spoke of his fear of insanity because of his false sensation of pain in the amputated leg. Recalling his own childhood feelings of revulsion at the sight of obvious physical disability, he was now fearful of attitudes toward himself.

In discussion with this patient, during which the worker helped him to clarify his feelings, he was not only able to face the seriousness of his experience, but also to realize his likeness to other men and his potentialities for normal living. During these discussions, it was evident that the patient tested social attitudes by observing the worker's reactions to him. From this time, he was able to participate more and more in social group activities, to leave the hospital for planned recreation, and later, to enter into the hospital's rehabilitation program in the form of job placement. The service given in this instance was a purposeful redirecting of thinking which permitted the patient to make use of his own capacities and to move toward resumption of responsibility.

Case 2.—A 38-year-old married man with four children who was a patient in the hard-of-hearing rehabilitation program, first came to the Red Cross for a loan in order to go home on a convalescent leave. Later he was referred by the psychologist because he was upset by conditions at home. In talking with the worker, the patient told her he believed his wife had a hernia and needed surgery. He was confused as to what was actually wrong with her and did not know what he could do for her. The worker offered to write to the Red Cross chapter in his town and ask them to visit his wife and send a report here, and when the report was received, the worker discussed it with him.

The chapter was well acquainted with the family. The wife had been having quite a great deal of difficulty in managing adequately for herself and the four children, all of whom were under 9 years. The main problems appeared to be the wife's poor health and her inability to use her family allowance to the best possible advantage. In addition to her need for regular financial supplementation, she has needed help in paying for tonsillectomies for the three older children.

The local chapter has assisted in reducing her rental and obtaining more adequate facilities by moving to a publicly sponsored housing project. She has been given help in planning meals which meet necessary health requirements

but stay within her budget limitations. The chapter has also assisted her to reorganize and reduce the civilian insurance which the family had been carrying. She was also enabled to obtain medical care for herself. However there is the problem of providing for the children during her hospitalization, as there are no relatives able to take over this responsibility and she will not consider placement in a foster home.

The chapter felt that in actuality the serviceman was needed at home, and it would be advisable for him to return to the family as soon as possible. The worker discussed this information with the patient's doctor who arranged for his survey to be expedited. He had completed his classes in lipreading and had already been fitted with a hearing aid. He will not have the opportunity of testing these new skills while still a member of the Rehabilitation Program, but under the circumstances of strain due to home conditions, it is felt he has obtained as much as possible from his stay in the hospital and could best be further helped by assisting him to return to his family.

Case 3.—An all too frequent problem coming to the attention of the social worker is one in which a physical disability and personal disaster seem related. This 20-year-old sergeant has been known to the social worker during his months on the rehabilitation service for the blinded. As the result of drinking wood alcohol while aboard ship, his vision became limited to only light perception and outlines of large objects.

All of his expressed and considerable concern has centered on his broken marriage plans. For 2 years prior to service, he considered himself engaged. Despite the girl's consistent objection to his drinking, regular correspondence was maintained during his absence in service, and upon his return to the States she visited him in a hospital on the West Coast. Her letters continued after his transfer to this hospital, but became infrequent after he told her the cause of his blindness. Then she telephoned him that she was breaking their relationship.

The shock of his loss was so great that at first he could think of nothing but rather wild plans for a cross-continent chase to talk with the girl and persuade her to reconsider. The social worker was naturally sympathetic with him in his great stress, but gently pointed out the impractical aspects of his impulsive plans. She encouraged him to view matters more calmly and to consider what things were most important to his future happiness. Gradually he came to feel that he and his former fiancée would probably never have been compatible. He realized that his disability had actually brought into focus their already existing differences. He even believed that if he pushed matters further she might marry him out of pity and he did not want that.

There was obviously underlying conflict because of the means by which he became blind, especially in view of his fiancée's attitude toward drinking. However, the patient did not express these feelings and it seemed wise to treat the surface problem as he presented it. He gave evidence of capacity to make a satisfactory adjustment at this level.

When his tension lessened, the social worker attempted to direct his thinking toward constructive action for his future. He is to go to the Institute for the Blind in New York City for a period of aptitude testing and job experience. He is already able to make use of his acquired skill in Braille and typewriting.

RECREATION

Since World War I, hospital recreation has been carried on in military hospitals under the American Red Cross. During World War

II, that recreation became recognized as a vital factor in speeding a patient's mental and physical recovery and helping him to return to society a better adjusted individual.

When the Rehabilitation Program for the amputees, blind, and hard-of-hearing patients was set up, the Red Cross was requested by the medical officers of the hospital to plan the recreation program for these patients. It was necessary for the staff to evolve a recreation program since no precedent had been established for the technic of recreation needed for these disability groups.

Recreation as it is now planned for all rehabilitees at this hospital starts with the patient as an individual, taking into account all his interests, then progresses to participation in groups, small, medium, and large. The final step in effecting a speedier mental and physical recovery of the patient as a well-adjusted member of society is through contact with the community. Joining with community groups in recreational activities in his status of a serviceman, later facilitates his transition to that of a civilian.

When the patient arrives at the hospital and is still undergoing medical and surgical treatment, recreation for rehabilitation begins. The worker sees the patient, learns of his interests and hobbies, then stimulates his interest in an activity. Games, music, diversional arts and crafts, and movies are brought to him while he is still in bed. In teaching a game, a card trick, or a craft, recreation is used as a tool to re-educate the patient in normal activities such as he engaged in before his disability. Even while working toward this goal, the worker attempts to bridge the transition from individualized interests to participation in group activities. This is started by having the patients play games with each other and often leads to competitive games and tournaments in which the whole ward participates.

During the early period of hospitalization, the relationship between the patient and the worker is on an individual basis and the patient often withdraws from taking part in social activities, especially when girls are present. Red Cross, as the channel for utilizing community resources, selects various groups of girls for parties that are held on the ward. These trained volunteers talk with the patients and play games with them, thus not only entertaining them, but also helping them in the initial step of returning to normal social contacts.

Dancing on the blind ward is one of the most effective activities for helping the patients to adjust to a group situation. Although many of these patients danced before they were disabled, practically all of them feel a reluctance to participate in this activity. Therefore for some it was a teaching process, but for all of them it was another means of being able to participate in community life.

Dancing has also proved effective for the amputees. This activity not only provides hours of recreation, but gives them ease and confidence in their ability to take part. It has been found that men who have learned to dance well have better muscular coordination and balance, and this in turn helps them to walk better.

When the patients have become adjusted to a controlled situation such as these dancing classes, they are eager to take part in the large weekly dances held in the auditorium for all ambulatory patients in the hospital. From this experience they gain a security in participating in social activities outside of the hospital.

The hard-of-hearing patient, too, finds his place in these large group programs. Because his loss of hearing causes him to feel that he no longer will be an accepted member of a group, he avoids all social contacts. Through the medium of dancing, he not only acquires poise, social ease, and self-confidence, but also regains a sense of balance and rhythm. With this group of patients, it is doubly important to give them a feeling of social acceptance. Although their disability is not obvious, their need for readjustment to normal activities is equally as great as that of the amputee or blinded man.

In addition to the recreation program planned for the bed patients, there are many small and large group activities in the recreation room which meet the leisure-time needs of the ambulatory patients in the hospital. For those interested in art as a medium of expression for thought, moods, and reactions, materials are provided that have an adequate range to satisfy the diversified interest and abilities of the patients. Many patients have had their first opportunity in the art room to try oil paints and have discovered a future hobby or interest, or a new understanding that art is an expression of very human common ideas.

Case report.—To a seaman, second class, an amputee who has spent a year and a half at the hospital, art activity has been of great importance, not only in helping him to pass the time, but in developing an ability that has increased his self-respect, brought him to the attention of his companions in the hospital and others in the community, and enabled him to find a satisfactory adjustment.

He had been hospitalized for a year when the art room was opened, and he was beginning to be most unhappy and doubtful about his future, as well as completely bored. When the recreation worker contacted him, he still was a bed patient and she learned that while he was in high school he had liked to draw. The worker followed through on this and provided him with colored chalks. In time his work attracted the attention of other patients, nurses, and the doctors in his ward. He was besieged with requests for pictures. Eventually through discussions with the art instructor and then with the education department, he took some commercial art classes in the city, then an apprenticeship in drafting. None of these activities, however, was quite what the seaman wanted and he gave them up. One day he came back to the art room and told the whole story of how each try had been a failure. By that time oil paints

had been added to our equipment and were suggested to him, and he agreed to try. This time he had found the medium he most enjoyed working in and has produced canvas after canvas. His own satisfaction in his achievements in painting is the most important factor.

Music has been a tool of expression for many of the amputees and hard-of-hearing patients. A Negro patient approached a recreation worker and asked her if she thought he could learn to play the piano, although he had only three fingers on his left hand. He told her that this was one of the things he had always wanted to do. The worker assured him he could learn to play and after many hours of learning and practicing, he is able to play several simple pieces without too much difficulty.

Two other (leg) amputee patients have renewed their interest in the violin and can be found most any time during the day in the music room practicing duets. A hard-of-hearing patient who had done a great deal of singing before entering the service wished to study voice. He feared he might not be able to sing again because of his disability. However, after a month of daily voice lessons in which training in the interval consciousness, proper enunciation and voice placement were stressed, the patient sang beautifully a group of solos at an evening entertainment. The patient had always wanted to sing in his home church and was encouraged to know that he could still hope to realize this ambition.

For the blinded, too, piano lessons were provided. However with these patients it was necessary to use the modern chord method of teaching and to rely a good deal on the patient's ability to play tunes by ear, since the men were not advanced enough in the study of Braille to read Braille music. Many of these blinded patients have found outlets in music, and one man became so interested that he planned to study piano tuning when he left the hospital.

For the patients interested in general recreation, there are the usual pool and ping-pong tables and card games in the recreation hall. Facilities for writing letters and for reading are provided. The evening programs are given over to small interest groups in music, crafts, stamp collecting, and special patient-participation events. In arranging parties and other large group activities, the patients also have an active part in the planning.

An example of this was the large patients' show which was originated by two patients who helped one night in an amateur program. After the rehearsals had started, interest in it ran high throughout the hospital. Many of the patients who had no special talent for the show offered to help paint the backdrop while others were willing to be the stage and property men just to have a part in the show. This show turned out to be a most successful venture and it even toured

the other hospitals in this area. This was a project in which each patient who participated had an opportunity for expressing himself and in so doing found he was providing recreation for others as well as making his own hospital stay more interesting.

During the summer, out-of-door activities at the hospital facilities are available for the more active types of games. One of these which has interested many amputees is the weekly putting tournaments held on the miniature golf course outside of the wards. Patients come each week in wheelchairs or on crutches and the competition runs high. During the rest of the week, the small course is crowded by men eager to practice in order to have a better chance to win the next tournament. This activity has been found helpful, too, in giving the amputees a better sense of balance and coordination. For the other patients as well as the amputees, the putting greens have opened a new avenue of recreation.

As soon as the rehabilitee has begun to take part in the group activities in the hospital, he is ready to go out on trips away from the hospital. This is another step in his final adjustment toward community life. At the special request of the rehabilitation staff, trips were planned every day away from the hospital to accommodate the amputees, the blinded, and the hard-of-hearing. These outings include all the facilities that a big city has to offer, such as sporting events, concerts, house parties, fishing, swimming, etc. Through the wide range of contact that the Red Cross has with community organizations, it has been possible to plan trips around the interests of the men. In addition to the daily trips, the patients have been offered opportunities to spend week ends in private homes. Care has been taken to see that the rehabilitee goes to a private home in a setting where he would feel most at ease.

SUMMARY

In the foregoing article, we have attempted to show how the American Red Cross, operating in a military setting, aids in the patient's adjustment to a disability and carries him over into civilian life. It was found necessary to use case material almost exclusively in the section dealing with social services because of the great difficulty of describing the technics used in case work process. It seemed the only means of indicating the need of flexibility in the light of each patient's situational needs.

We have touched on the relationship with the network of Red Cross home chapters and their function in the program and their potential contributions to it. They represent, in a sense, an established and continuing source of aid to the patient after his discharge from service to civilian life.

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